Annual Report of the
Agricultural Department,
Bengal, 1886-87, 1910-11 and
1912-13 to 1918-19

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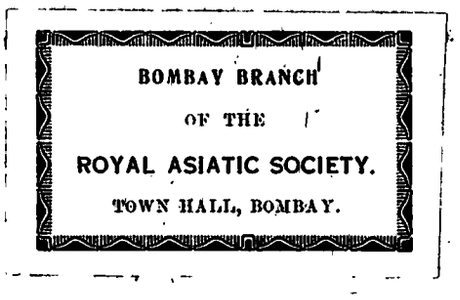

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ANNUAL REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL.

FOR THE YEAR 1886-87. and
1910-11, 1912-13 & 1918-19

133013

Calcutta;
PRINTED AT THE BENGAL SECRETARIAT PRESS.
1887.

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OFFICE OF THE DIRECTOR OF THE AGRICULTURAL DEPARTMENT, BENGAL.

No. 1264Agri.

FROM M. FINUCANE, ESQ., C.S.

Director of the Agricultural Department, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

(THROUGH THE BOARD OF REVENUE).

Dated Calcutta, the 16th August 1887.

SIR,

IN accordance with the orders of Government conveyed in paragraph 2 of the Resolution, dated 11th January 1887, on the first Annual Administration Report of the Agricultural Department in Bengal, I have the honour to submit, through the Board of Revenue, a report on the operations of the Department to the end of the official year 1886-87. The first report dealt with the period from the date of my delegation on special duty to the end of July 1886; but as the orders passed on that report directed that future administration reports should be for the official year, the present report will have special reference to the period from July 1886 to the end of March 1887, and, therefore, will be supplementary to that already submitted, so as to bring the narrative up to the end of the financial year, rather than an administration report for the whole official year.

CHAPTER I.—ORGANIZATION AND MAINTENANCE OF VILLAGE RECORDS.

The work done during the year in connection with the organization and maintenance of village records consisted in the supervision of surveys and the preparation of records of right, the principal of which will be found described below—

Cadastral Survey and Settlement operations in Mozufferpore.

2. The circumstances which led to the undertaking of a cadastral survey and record of rights in the Mozufferpore district under chapter X of the Tenancy Act as an experimental measure were described in my first annual report, and a *resumé* was given of the results of the operations so far as they had then gone. The survey operations were stopped, in accordance with the orders of Her Majesty's Secretary of State, in July 1886, and the progress of settlement work was also stopped in the November following, except only in 235 villages, the draft record of which had been published under the first part of section 103 of the Tenancy Act.

3. From the commencement of the operations to the 31st March 1886 the demarcation of 916 villages comprising an area of 566 square miles had been completed. The total area cadastrally surveyed up to that date was 219·93 square miles, and the records of 68 villages, comprising an area of 16 square miles, had been made over to the Settlement Department for attestation. The attestation and record of rents had proceeded in 24 out of these 68 villages.

4. No progress was made in demarcation after 1st April 1886, but the trijunctions of 892 villages comprising an area of 555 square miles, in Chukla Gurjaul, pergunnah Bisara, and in pergunnah Ratti, were marked out with stone pillars. During the year 47 boundary disputes were reported, making a total of 350, and 86 were disposed of, making a total of 230 since the beginning of the operations.

5. The cadastral survey operations continued up to July, and an area of 193·91 square miles was completed, in the year under report, making a total of 413·84 square miles cadastrally surveyed. The records of 552 villages in all, with an area of about 300 square miles, were made over to the Settlement Department before the survey office was closed in October last. In addition to the area cadastrally surveyed, the professional traverse survey of the boundaries of 1,356 villages, comprising an area of about 700 square miles, had been completed in advance of the cadastral work.

6. Out of the 552 villages of which the survey records had been made over to the Settlement Department the work of attestation of holdings and record of rents was completed, before closing operations, in 356 villages, with an area of about ·155 square miles. Existing rents were recorded for 43,778 holdings, and of these, again fair rents were settled under section 104 of the Tenancy Act in 13,370 instances. The following are the details of classification of holdings of the 43,778 ryots whose rights and rents had been thus ascertained :—

Ryots at fixed rates	2,033
Settled ryots	36,250
Occupancy, but not settled ryots	340
Non-occupancy ryots	2,691
Under-ryots	2,430

Besides the 356 villages in which attestation of holdings had been completed, the local explanation of the entries in the khatians had been carried out in about 150 villages more.

7. The settlement operations were finally stopped in November, even in villages which had been surveyed, and of which existing rents had been recorded, except in regard to the villages of which the draft record had been published under the first part of section 103 of the Tenancy Act. The records of 235 villages had been thus published, and Mr. Collin has since been engaged in disposing of objections made under section 106 and in preparing the records for final publication. This work was well advanced at the close of the year, but the disposal of contested objections, involving in each the protracted procedure of a civil suit, has necessarily taken some time to complete.

Moreover, Mr. Collin, in addition to the supervision of this work, was also called upon to co-operate with the Settlement Officer of Goruckpore in the settlement of disputed boundaries between Bengal and the North-Western Provinces. The Assistant Settlement Officers were also transferred—Baboo Nundji at the end of November, and Baboo Barhandeo Narain at the close of December.

8. There were altogether 1,045 petitions of objection registered, of which 678 were contested, and had to be tried as civil suits. At the close of the year 143 objection cases, affecting the records of seven villages, where disputes were numerous, were pending, and the rest had been disposed of. Since the end of the year the settlement operations have been brought to a close, and Mr. Collin's final report, which will soon be submitted to the Board, has been received.

9. From the statistics of the 235 villages of which the final record has been published, it appears that 78 per cent. of the whole area is cultivated, and 22 uncultivated, but from among the latter, 3 per cent. is rent-paying land under thatching grass, 5·3 per cent. is under orchards, and 7 per cent. is unfit for cultivation, so that only 6·4 per cent. of the entire area of these villages is left for pasture land, which, though of inferior quality, may possibly be brought under cultivation if no land were left for grazing. When it is remembered that the agricultural population of this tract (which does not include the town of Mozufferpore) is 824 souls to the square mile, and that this population increased 15 per cent. within the last decade, it will be seen how little room there is left for extension of cultivation, and how great is the pressure of the existing population on the resources of the soil. The rent-paying area is 79 per cent. of the whole, and the land held by proprietors as nij-jote or cultivated by them but other than nij-jote, is 16 per cent. The lands recorded in the proprietor's possession, but not nij-jote or *sir*, exceeds that recorded as really *nij-jote, sir* or *zeraat*, in the proportion of about 5 to 3.

10. As regards classification of holdings in the 235 villages of which records have been finally published, it appears that there are in these villages 26,066 holdings, which are divided as follows :—

		Per cent.	
Ryots at fixed rents—			
Resident	1,551	5·95	7·39
Non-resident	376	1·44	
Settled ryots—			
Resident	17,052	65·41	85·30
Non-resident	5,187	19 89	
Occupancy but not settled ryots—			
Resident	75	·28	·63
Non-resident	93	·35	
Non-occupancy ryots—			
Resident	995	3·81	6·63
Non-resident	737	2·82	

11. It was always known that a very large proportion of ryots in Behar were, as a fact, possessed of occupancy rights, but without the facilities afforded by the presumption in favour of those rights by the Tenancy Act, it would not have been possible for the ryots to prove their existence. The average area of a holding is small, being approximately 1½ acres; but this area does not represent the average quantity of land held by each individual, for some ryots cultivate in more than one estate, or in more than one village. Thus while the total number of holdings is 26,066, the total number of ryots is 19,495. Making allowance for these facts, the average holding of a settled ryot appears to be, as nearly as possible, 3 acres. The area of holdings of settled ryots is larger than that of non-occupancy ryots, which on an average is about 1½ acres.

12. The average rental per acre is found to be a fraction over Rs. 3. This is probably a higher all-round-rate than prevails in one other province in India, and it must be remembered that this average is arrived at by spreading the total rental over the entire rent-paying area, which, as all culturable land has been brought under cultivation, includes land of the most inferior descriptions, while the average of other provinces is struck on only the comparatively small percentage of the entire area brought under cultivation, in which land of the most inferior qualities is not included. Moreover the villages in which the draft record had been published before receipt of orders stopping the proceedings, and in which alone the operations have been carried on to completion, were those in which the relations of landlord and tenant were most harmonious and where rents had not been screwed up, as much as elsewhere in recent years. Though these rents, may not appear to be high in themselves, gauged by the standard of other countries, yet they were, Mr. Collin reports, evidently much lower in recent years, and they have, he adds, been enhanced, not by any legal process, nor on any legal principle, but in many instances by the arbitrary exercise of proprietory power, by unscrupulous resort to the Civil Courts, and by abuse of the rights of contract.

13. In only about 33 per cent. of the holdings were fair rents settled on the application of the parties under section 104 of the Act. This settlement was generally effected on the verbal application of the ryots, and took the form of an uncontested suit, the landlords admitting the existing rent to be fair. In no case was formal application made for an enhancement or reduction of rent. The reason for this forbearance on the part of the landlords was, Mr. Collin thinks, their apprehension lest by attempting to have rents enhanced they should drive the ryots to under-state their existing rentals, the amounts of which the landlords were doubtful of their ability to prove.

14. The survey and settlement has, Mr. Collin reports, been carried on without any friction or serious difficulty. Some of the proprietors and landlords, especially the managers of indigo factories, gave him great assistance, and bore with patience and good-will all the trouble which the inauguration of a new work of survey and settlement must cause. The

absence of friction was shown by the facts that in only two or three petty cases did the operations lead to a breach of the peace; only one application objecting to the proceedings (and that an anonymous one) was made to the Board of Revenue in its executive capacity; no appeals in regard to boundary disputes went beyond the Settlement Officer to the Commissioner; of 498 cases decided as contested civil suits up to the 31st March, in only 42 were appeals made to the special Judge, and in these the judgment of the Settlement Officer was upheld in 11 and reversed in only 3 cases.

15. As regards the attitude of the parties, Mr. Collin says that the ryots eagerly attended at the attestation of the records, and took great interest in having their fields and rents correctly recorded. They also came freely into the Settlement Office to receive copies of their khatians (abstracts of holdings), and objected when the entries in these khatians were not correct They appreciated the value of the abstracts of holdings which were given to them, and the Settlement Officer does not believe that they will allow more rent to be illegally exacted from them hereafter than is therein recorded. The effect of these records in enhancing the value of ryots' property is, he adds, already visible in the sales of holdings which are taking place in settled villages. The ryots were, in Mr. Collin's opinion, disappointed at the closing of the settlement in villages where operations had commenced, and in a few cases they petitioned for its continuance and offered to pay the cost. When the general lethargic character of Behar ryots is considered, this, he adds, shows greater earnestness on their part than would at first appear probable, especially when the effect of taking of such a step without the consent of the proprietor is remembered. I also think that the ryots, notwithstanding some attempts made to deceive them, appreciated and liked the proceedings. The landlords were led by persistent misrepresentation to suppose, that as the proceedings were initiated by Government, they must necessarily be intended to injure them, but though frequently invited to show anything in the proceedings that was in fact unfair or unjust they have been unable to do so in any single instance. It would, however, be unreasonable to assert that Behar zemindars can have had any real liking for proceedings which must have the effect of putting restrictions on the arbitrary powers of enhancement of rent at present exercised by them, or that indigo-planters can have any real desire for the continuance of operations which would render it difficult and dangerous for them to take arbitrary possession of ryot's land.

16. The total expenditure of the Settlement Department from beginning to the end of the durations has been Rs. 63,668, and the total expenditure of the Survey Department to end of October, when the Survey Officers left the district, was Rs. 1,29,116, or for both survey and settlement, Rs. 1,92,784. The expenses incurred are no test of what the cost of these operations would be if they were regularly conducted on a large scale. The above sum includes the cost of demarcating trijunctions with pillars over an area of about 700 miles in addition to what was actually surveyed, and the price of about 1,200 pillars which are now lying at Hajipur. If the cost of the 700 miles of which traverse survey had been completed in advance, and the price of these pillars is deducted, the cost of the operations on the area cadastrally surveyed will be materially diminished. It is to be remembered that settlement operations did not begin till the hot weather, and that then the records of a connected area were not given, so that much time was wasted in moving from place to place. Again, the uncertainty which existed as to whether operations might not be brought suddenly to a close rendered economy difficult, and, moreover, the expenses incurred include a large initial outlay for tents, office furniture, transport of camp equipage and travelling allowances of officers joining their appointment, all of which, if the operations had continued, would have been chargeable to a larger area. The cost of the cadastral survey, inclusive of traverse work, is reported by the Survey Department to have been Rs. 255 per square mile, or a little under 6½ annas per acre.

17. I expressed at some length, in my first annual report, my opinion regarding the necessity for a survey and record of rights in Behar, the inefficacy of the Tenancy Act without a survey and record of rights, the results of the operations, and the probable effect of stopping them, and do not think it necessary to discuss these subjects again in this place, further

than to say that the facts since elicited in the course of the settlement operations, which will be found detailed in Mr. Collin's final report, soon to be submitted, do not afford any ground for altering the opinions expressed, in paragraph 22 to 25 of that report but on the contrary confirm and support them.

Cadastral Survey and Settlement Operations in Government Estate of Angul.

18. The Government estate of Angul lies within the geographical limits of the Tributary Mehals of Orissa, and was at one time a native State. The Chief of the State rebelled and was dethroned, and the State was confiscated in 1847. Since then it has been managed as a Government estate. It contains an area of 881 square miles, of which about 476 are supposed to be under cultivation.

19. The current settlement will expire in September 1887, and as a regular survey of the estate has never been made, it was deemed desirable to have a professional survey now made in connection with the resettlement of the Government revenue. The outer boundary runs along the borders of Tributary States, and being in many parts disputed, the demarcation of it is a work of some difficulty. A detachment of a professional party completed up to the end of the year 1886-87 the traverse boundary survey of 340 square miles. It was at first contemplated to have the cadastral work carried on under the supervision of the Professional Department, through the agency of up country and Bengalee amins; but having visited the estate in March, I recommended that an establishment of Bengalee amins, who had been employed by the then Settlement Officer in excess of the requirements of the case, should be discharged, and that the indigenous agency of surbarakars should be utilized for the purpose of carrying on the field survey. The Board and Government accepted the proposal, and surbarakars are now accordingly being trained in survey work. The local tehsildar, who is really a sub-divisional officer in every thing but the name, and Mr. A. K. Raye, a Cirencester graduate, who had been deputed to learn surveying in the Central Provinces, have been appointed Joint Settlement Officers, and they report that the surbarakars have shown great readiness to co-operate in carrying out the survey in the manner proposed. More than 250 of them have either come forward themselves or have deputed nominees on their behalf, who are being taught to survey, and will afterwards maintain the records, while more than one hundred surbarakars or their nominees are reported to have already learnt something of surveying. It is however, reported by the Settlement Officers that the native subordinates of the Professional Department, fearing that the employment of indigenous agency means the supplanting of themselves, are placing obstacles in the surbarakar's way, and it has been, therefore, arranged with Colonel Sconce that the survey officers are to be absolutely prohibited from employing on the field-to-field measurements any up-country or Bengalee amins or measurers, other than the surbarakars and their nominees trained at Angul; and further that if, by means of this indigenous agency, so trained, it should not be found possible for the Professional Department to complete the cadastral survey next cold-weather at a very moderate cost, the entire supervision of survey of the area then remaining will be undertaken by the Settlement Officers. The cadastral survey of 61½ square miles has been completed this season, but the records had not been made over to the Settlement Officers at the end of the year. The sum of Rs. 1,95,294 had been sanctioned for this work, but under the arrangements now made it is hoped that half of this amount will suffice.

Settlement of the Nulchira chur in the Noakhally district.

20. The supervision of the settlement of the Nulchira chur was made over to me at the end of the year. This chur became the property of Government in 1835 under the operation of Regulation XI of 1825. It was subsequently divided into two mehals, one of which was settled with the predecessors in title of one Fazl Rahman Chowdry and others, and the other with the predecessors in title of the Jackson minors, who respectively are the present settlement-holders. The settlement in each case was identical

in all material respects. It was a "temporary talooqdari settlement" for the period of 30 years, with a right to a re-settlement on suitable terms at the expiry of that period. The settlement expired in 1869, and proposals for a re-settlement were laid before the Government. The outcome of these proposals was an order to settle with those among the *abadkars*, who, by residence, position, and influence, were fitted to be admitted to settlement. The order also provided that the settlement-holders' tenure should not be unconditionally heritable and transferable; that every devolution required previous sanction; that the settlement-holders' right should wholly lapse if they or their successors refused to agree to the terms offered at any subsequent re-settlement; and finally that only those successors who were deemed qualified to discharge the duties appertaining to the position should be admitted to settlement on future occasions. The order in regard to the disqualification of heirs was subsequently modified by instructions from the Government of India recognizing the right of the Jackson minors, who came within the disqualifying conditions, to claim a settlement. The orders of the Bengal Government laying down the principles on which the settlement should be made do not seem to have been carried immediately into execution, while the effects of a storm-wave which devastated the *chur* in 1876 rendered a re-measurement necessary and caused further delay. When the settlement was taken in hand, the proceedings were conducted in accordance with the provisions of Act VIII (B.C.) of 1879, the present settlement-holders being regarded as tenure-holders, and the rights of the subordinate ryots being recorded under the provisions of section 7 of the Act. The proceedings did not give satisfaction to the settlement-holders, who, having failed to obtain a modification of them from the Board of Revenue, appealed to Government.

21. The settlement-holders claimed to have their titles declared, without any reservation, to be permanent, heritable, and transferable. They asserted their right to settlement without any record being framed of the rights of tenants who hold under them, and they claimed immunity from any higher assessment than Rs. 3 per *kani*. The last claim, namely, immunity from any higher assessment of revenue than Rs. 3 per *kani*, was rejected as inadmissible, as no such claim can be maintained on the terms of the *dowl* or lease granted in 1839.

In like manner the claim to freedom from the operation of the law regarding the procedure of assessing revenue [Act III (B.C.) of 1879] was disallowed.

22. As the representatives of the original clearers of the soil, the settlement-holders and their successors were declared to be entitled to a heritable and transferable right in their taluks, each taluk being regarded as an indivisible whole. This right Government ordered also to be regarded as permanent, so long as the settlement-holders or their successors agree to the assessment of revenue imposed at a re-settlement of the taluk. Refusal to agree to such assessment, or failure to fulfil the obligations thereby imposed, would, it was declared, involve the forfeiture of all the rights in the taluk which the settlement holders or their successors may possess; and it would thereupon be competent to the Government to make in regard to the taluks whatever disposition it pleases.

23. The proceedings connected with resettlement of the Dearah, though begun some years back were not owing to the causes above described, completed before the passing of the Tenancy Act. It was then deemed expedient to apply to the resettlement of this chur the provisions of Chapter X of that Act. The measurements already made were tested and found to be correct, and the areas of holdings, as ascertained by the previous survey, were acordingly accepted without remeasurement, subject to any objections which may be made to them when the draft record is published under Rule 33, Chapter VI of the Tenancy Act rules, which objections will have to be heard and decided as civil suits under Rule 32. Holdings have been classified in accordance with the provisions of the Tenancy Act and existing rents have been ascertained. Fair rents are now being settled by the Settlement Officer, Munshi Nundji, and it is hoped this long-pending settlement, together with the preparation of a record of the tenants' rights on the chur, will be concluded at an early date. The total area of the chur is 13,425 acres.

Survey and record of rights of Wards' Estates.

Sunkerpore Ward's Estate in Dinagepore.

24. The survey and preparation of a record of rights in this estate was undertaken on the recommendation of the Collector of Dinagepore and Commissioner of Rajshahye, on the ground that there were no proper records of areas and of the rents of holdings, and also because it was supposed that the operations would lead to some increase in the ward's rent-roll. The work of survey has been carried on by a detachment of a professional party, while the record of rights and settlement of rents have been entrusted to Baboo Shushi Bhusan Dutt, a Sub-Deputy Collector. The total area of the estate is 270 squar emiles, of which 199 had been surveyed during the year, and an area of 71 square miles remains to be done. The cost of cadastral survey has been 6 annas per acre, which, though, as will presently be shown, lower than that of work done last cold-weather by non-professional agency in the same district, in the Churamon estate, is still higher than would appear to me to be desirable or necessary. The subject of effecting reduction in the cost has been discussed with the Deputy Surveyor-General, and if such reduction cannot be made, it will be a question for consideration next season, whether the work of the professional department should not be confined to traverse survey, the supervision of the field-to-field survey being entrusted entirely to the settlement officers, as is done in the Central Provinces. The different estates appertaining to this property are scattered throughout parts of the Dinagepore, Maldah, and Rajshahye districts, and this circumstance has added to the cost of the work.

The expenditure on the preparation of the record of rights and settlement of fair rents amounted to only Rs. 1,905 to end of June; but this work is only being now begun.

Churamon Ward's Estates.

25. These estates contain an area of 166,009 acres, or about 259 square miles. A non-professional survey of them by chain and compass was begun so far back as August 1884. An area of 1,22,715 acres had been surveyed in this manner up to March last, when it was decided that the survey of 39,244 acres, which remained to be done, should be carried on under the provisions of chapter X of the Tenancy Act, and the control of the settlement officer's work as regards this latter area was transferred to me. The area surveyed during the year under report is 20,173 acres, and the expenditure has been Rs. 9,366 or over 7 annas per acre. It thus appears that the cost of the non-professional and inferior chain and compass survey has been more than that done by the professional department in the same district and under similar conditions.

26. No settlement work has been done in these estates during the past three years. The old rent-rolls have not been revised, nor have new rent-rolls been framed, neither has a proper record of rights been prepared. The accumulation of settlement work now to be done is therefore very great. It was intended that the Manager of the estate should revise the rent-rolls and make amicable arrangements with the ryots on receipt of the measurement papers from the Sub-Deputy Collector, and it is hoped that he will now be able to undertake this important work without further delay. But in any case the undivided attention of one officer must be devoted to the survey and settlement operations in the area which remains to be done under the Tenancy Act.

Chapter II.—Analysis of Districts.

27. Enquiries were made in the months of November and December by Mr. A. C. Sen in Dacca and Mymensingh, and by Mr. Sakhawat Hossein in Dinagepore, with a view to the preparation of reports on the agricultural practices of these districts, similar to that submitted for Burdwan in the previous year. These enquiries are not yet completed, but the general conclusions come to by Mr. A. C. Sen, as the result of his enquiries, from a comparison of the agricultural systems prevailing in these districts and Burdwan may here be mentioned. They are that—

(1). The soil in most parts of the Dacca and Mymensingh districts is very good—in some places almost unrivalled in fertility, and the facilities for

profitable cultivation are very great, but the cultivators, as a rule, are lazy and devoid of any spirit of enterprise.

(2). There is a large tract of land including the Madhupur jungle and its outskirts, and bounded by the rivers Bansi, Buriganga, Brahmaputra, Lukhya, and the Jenai shown by red lines in the map annexed, the agricultural resources of which are very great, but which require capital and enterprize for their proper development.

(*a*). This tract is very well suited to sugarcane, and it is the best land which Mr. Sen has seen, excepting perhaps that in the neighbourhood of Tipperah, for the cultivation of that excellent variety of cane known as the Bombay, which, for the size to which it grows and the abundance and richness of its juice, has no rival in any part of India. If properly utilised, this tract can, he thinks, produce sugar sufficient to supply the demands of the whole of Bengal, but very little sugar-cane is grown on it at present.

(*b*). Cotton was formerly grown extensively in this tract, the soil as well as the physical aspect of the place being very well suited to the cultivation of it. The cotton raised here, though rather short in staple, was the finest known in any part of the world, and formed the material out of which very delicate and extremely beautiful Dacca muslin was manufactured. Since the decline of that celebrated fabric, the cultivation of cotton has almost entirely ceased in this tract. Considering the high price that cotton fetches in most parts of Bengal, and the improvement that has been effected in the yield of it by the introduction of some of the best American varieties, the cultivation of this important crop may be revived in this locality with great advantage.

(*c*). This area abounds in land that will grow first class tobacco.

(*d*). This tract is also suited for the cultivation of rhea and mulberry, both plants being found wild there.

(*e*). Both Dacca and Mymensingh abound in land that will grow potatoes of very superior quality, but at present the cultivation of potatoes may be said to be almost unknown in these districts.

(*f*). Ground nuts may be cultivated with great profit on the high sandy banks of the Lukhya, Brahmaputra, and Meghna rivers where the cultivation would cost very little, and the profit would be much greater than is at present obtained from jute.

28. Mr. Sen has arranged to have experiments tried by zemindars and ryots in Dacca and Mymensingh on the use of bone-meal, castor-oil cake, and saltpetre as manures, and in the growth of ground-nuts; and I shall myself also take an early opportunity to visit these districts, and, in consultation with the local officers and zemindars who are interested, endeavour to ascertain whether the improvements suggested may not be introduced by the latter.

As regards the existing agricultural practices, Mr. Sen remarks that the ryots of East Bengal take very little care to manure their fields They seldom apply oil-cake, hide salt or any other bought manure, and do not often make the best use of the cattle-dung which they have available without purchase.

It may be here remarked that because of the large extent of land now put under jute in these districts, the necessity of adding purchased manures to the land, in order to maintain its fertility intact, is increasing every year. The land on which jute is grown was formerly either set apart for grazing purposes, or was sown with *aus* paddy. In either case the cultivation of jute has reduced the quantity of cattle food and therefore of manure. Anybody travelling through the interior of the Mymensingh district will be surprised to find that in a place like this, where the land is most fertile, fodder is very scarce and the cattle wretched.

The Beheea Sugar-cane Mill, which has produced almost a revolution in the sugar-growing districts of Behar and on this side of river Padma, is unknown in Dacca and Mymensingh. The art of *gur*-making is also little known or practised, so that though the extent of land capable of growing sugarcane in these districts is probably greater than in any other part of Bengal or Behar, yet the supply of sugar for local consumption comes from such distant places as Ghazipore and Benares.

In the *charas* of Meghna and Dhaleswari, Mr. Sen met with a fodder grass known locally as *lataghas* or *khyla*, which probably belongs to the same species as sugarcane. This fodder is extensively cultivated in some places, especially in the western part of the Moonshiganj sub-division. During the last rains, when the greater part of Dacca suffered from high floods, and when other fodder was most scarce throughout the district, this grass saved the lives of thousands of cattle, and owners came to buy it from a distance in some cases exceeding 50 miles. *Lata* is supposed to be a very nutritious food, and is much appreciated by cattle. As food for milk cows, it is believed by raiyats to increase the quantity of milk and to improve its quality. The cultivation of this grass is very simple. A number of plants are taken off a field and cut into small pieces. These cuttings are then planted in the soft mud left near river-sides on the receding of the inundation water. No further care need be taken of it till the time comes for cutting. The outturn of a bigha is in ordinary years said to be worth about Rs. 20. Once planted it will give one cutting annually for three successive years, after which the field should either be broken up and sown with some other crop, or replanted. The plant seeds freely, but the first full crop is not obtained earlier than the end of the third year.

The cultivation of this grass would appear to be capable of much extension, and an attempt will be made to grow it on the banks of the Ganges near the experimental farm which has been opened at Sibpore.

A careful analysis of districts will now be undertaken in accordance with the orders of the Government of India conveyed in their letter No. 219R—65-3, dated 11th May last.

III.—Collection of Rent and Revenue in precarious tracts.

29. According to the orders of the Government of India, the consideration of this question is to be confined to districts which have been the subject of particular analysis. As regards the districts of Dacca and Mymensingh, in which partial enquiries only have been made, no remarks are at present called for on the subject of the collection of rent and revenue, the latter it is believed being nowhere precarious in these districts.

Chapter IV.—Measures of Protection, including Arboriculture and Fodder Reserves.

30. It was reported in the first annual report that a proposal to turn the Government estates, on the Rhotas plateau, in the Khymore Hills, into a fodder and fuel reserve, had been submitted to the Board of Revenue. This proposal is still under the consideration of Government, and it is hoped that a Forest Officer will be deputed to Rhotas next cold-weather to enquire and determine, in communication with the Sub-divisional Officer, what trees should be preserved and what rules should be made for formation of a fodder and fuel reserve.

Planting of trees by roadside and in Government, Wards' and other Estates.

31. A circular letter has been addressed to local officers calling attention to the orders of Government on the subject of planting trees by road-sides, giving a list of trees which Dr. King, the Superintendent of the Botanical Gardens, is willing to supply gratis to public bodies or private individuals, and suggesting that in connection with questions of arboriculture, more advantage might be taken of the aid and advice of Dr. King, than has hitherto been the case. In response to this circular, applications for trees of different kinds have been received from many District Officers and Municipalities. A further circular, containing detailed instructions for planting trees by road-sides and elsewhere, is now being prepared in communication with the Superintendent of the Botanical Gardens, and with Mr. Worsley, who, as Collector of Mozufferpore, gave much attention to this subject, and this circular will, it is hoped, be of some assistance to local officers.

Reclamation of usar lands by planting trees.

32. Having noticed in the *Indian Agriculturist* that Mr. Maries, Superintendentof Gardens of the Maharajah of Durbhunga, had succeeded in reclaiming lands impregnated with saline matter by planting certain trees upon them, a letter was addressed to him, asking for further information on the subject. In reply, Mr. Maries wrote as follows :—

"When I came to Durbhunga six years ago, I was much troubled to know what to do "with certain patches of saline soils of the worst description. One was the site of an old salt-"petre factory where even weeds would not grow. I had this soil dug deep (2 feet) and planted "thick (3′ × 3′) with *Inga Saman* (rain trees), *Albizzia Procera, Albizzia Lubbuk, Cassia* "*florid millingtonia hortenus, sissoo, neem, &c.* The best were the two first named. They were "sown in pans, transplanted when the second leaves developed into single pots, and grown on "till about 3 feet high in pots. The salt ground was prepared as above, and the trees planted "early in the rains. The ground in three years was completely filled with roots, and to all "appearance the salt gone. The trees were thinned out last year only leaving the best, and the "ground is very good now.

"In another place near my house, where the ground was covered with white salts "quite one inch thick, and where nothing would grow, I had holes dug 4′ × 4′, and new "earth filled in, and large trees 12 months old transplanted with good poles, I gave the measure "ments of two on the worst ground to prove how they have grown—Albizzia 5 years old, height "40′, girth of trunk 4′ from ground 3′ 10″. A rain tree same age, girth 1′10″, height 20′, a "spreading tree. The ground now is covered with *doob* grass, and I have some splendid "plantains growing there.

"The trees I think should be thoroughly established in pots before planting, and this should "be done in favourable weather just at the commencement of the rains.

"The Inga Saman produces such an enormous quantity of surface feeding roots, and these "yearly decay, leaving a rich deposit of vegetable matter in the ground, and making the soil "open, and I have no doubt the trees take up the salts too, that in a few years the nature of "the soil is completely changed. The trees should be planted as thickly as possible.

"The timber is first rate for firewood, and the trees bear lopping well. I should think it "would be an excellent tree for swampy feverish places in Bengal or elsewhere, being such an "enormous water-absorber; it is as valuable as the willow or eucalyptus, the willow being used "by the Chinese as a preventative for fever, and always planted round villages in rice "districts.

"Albizzia is said to be a valuable timber; it is certainly a very handsome tree. I can give "you a supply of seeds, if you care to have them, for distribution and trial in other places.

"Rain tree seeds can be obtained from Dr. King, Seebpore Botanical Gardens."

Though the question of reclamation of lands impregnated with saline matter is not of such importance in these as in other Provinces, yet it is by no means an unimportant one in Behar, where considerable areas of saline soil are to be found. Dr. King, who was consulted on the subject, sees no reason to doubt the correctness of Mr. Maries' conclusions, and trees have been supplied by him for experimental cultivation on saline soil to District Officers who have applied for them.

A sample of the original soil reclaimed by Mr. Maries is at the same time being analysed with a view to determine how far it really contained saline matter.

Experiments in the cultivation of the date-palm.

33. The distribution of Dr. Bonavia's book, "The Date-palm in India," drew attention to the subject of the cultivation of the date-palm, and attempts were made to introduce this tree into the districts of Patna, Burdwan, Orissa, and Bhagulpore. The results may be said to be everywhere unsatisfactory. In some districts the seedlings failed altogether, and in none have they done well. The climate of Bengal appears to be too damp for this plant.

Eradication of disease among silk-worms.

34. The most important of what may be called protective measures taken during the period under report were those instituted in connection with the eradication of disease among silk-worms.

In the course of enquiries instituted at the instance of the Government of India on the suggestion of Mr. Wardle with a view to ascertain the cause of the decline of the Bengal silk industry, it transpired that, though the high and differential rates of rents charged on mulberry lands in some of

the mulberry-growing districts may have had a prejudicial effect on the silk industry, yet the effect was not so serious, as Mr. Wardle had been led to suppose, and that the main cause of this decline is the spread among the worms of diseases. Of these the most dangerous is known to the rearers as *kata*, pronounced by Mr. Wood-Mason to be the same as *pebrine*, which had in recent times broken out in an epidemic form in the south of Europe and caused great destruction of silk-worms. Other diseases also prevail, but they have always been known to the cocoon-rearers, and are of comparatively little importance, while *kata*, which has only been noticed within the past twelve years, is yearly becoming more and more destructive, and is at present causing most serious alarm. Mr. Wood-Mason, Superintendent of the Indian Museum, and Baboo Nitya Gopal Mookerjee, one of the most distinguished of the Cirencester graduates, were deputed to enquire into the nature of the disease, and the results of their investigations and of a local enquiry made by myself were laid before a Conference held in March last, under the presidency of Sir Edward Buck, which was largely attended by the mercantile community. After the subject had been very carefully gone into, it was settled that certain remedial measures suggested by Mr. Wood-Mason, and by Mr. N. G. Mookerjee, should be adopted. These measures are (*a*) the introduction of M. Pasteur's system by which moths intended for seed are microscopically examined, and the eggs of such as are found diseased are rejected; (*b*) the introduction of healthy conditions, that is to say, fresh air, cleanliness, plenty of space, and exercise in the rearing of cocoons, all of which conditions are ignored in the system at present followed by the rearers. It was also decided to get out a French or Italian expert in silkworm diseases, and to associate him with Mr. Mookerjee in the microscopic examination and selection of healthy seed.

The expert has not yet arrived, but Mr. N. G. Mookerjee has himself been working since that time, according to the plan then drawn up and already partially acted upon. He has since submitted three reports on three successive experimental crops.

His first report, describing the first series of experiments made by him, was circulated among gentlemen interested in the Indian silk industry for any remarks or suggestions they might wish to offer. Replies have been received from many of them, and are generally to the effect that the results of the experiment, so far as they go, are satisfactory, and that a good beginning has been made in the attempt to grapple with disease among silkworms.

The native rearers have shown a preference for the seed reared and microscopically examined by Mr. Mookerjee to that reared in the ordinary way, and went so far as to incur the expense of buying, according to his advice, untainted mulberry leaf at a high price, rejecting leaf in their possession which is believed to be tainted, by use on the land, on which it was grown, of manure containing excreta of diseased silk-worms. Mr. Mookerjee now thinks that he has eradicated disease from his experimental Madrasi stock and he is probably right; but it remains to be decided by the expert from Europe, who is soon expected, whether he has really done so. If it should prove that he has, then the question of the extension of methods adopted by him will have to be carefully considered. Enquiries are also being made on the subject of the natural history and ravages of the silk-worm fly, of which little is at present known.

Chapter V.—Agricultural Experiments, including Farms.

Burdwan Raj Experimental Station.

35. During the rains of 1886-87 considerable damage was done to this farm in a variety of ways. It was stated in the last year's report that the site allotted by the Raj managing authorities for the farm is not the best that could be desired, but the proximity to the Eden Canal was regarded as a great advantage. The experience of the last rainy season has proved that the proximity to the canal is not an unmixed good. In the month of September the portion of the canal which is near the experimental farm was kept at a high level to deliver water to the ryots at a time when it was raining almost incessantly, and when therefore there was little need for artificial irrigation. The site of the experimental farm being low, and the embankments of the canal being made of very

porous sandy soil, water oozed through them and the whole farm thus became submerged. Some of the standing crops, such as rhea, ginger, turmeric, brinjal, and cotton, which require high well-drained land, were either partially or wholly destroyed. Moreover at the end of the rains it was found that the land that had been brought into condition at considerable expense and trouble, had acquired the consistency of sunburnt bricks, and this threw back potato planting by nearly a month.

(I). Manure experiments were made with paddy with the following results—

1. *Paddy.*

Plot No.	Manures used per acre in lbs.	Price of manures.	Outturn per acre.	Money value of the outturn.	Remarks.
	Field 1.	Rs. A. P.	lbs.	Rs. A. P.	
1	No manure	.....	1,191	14 14 3	
2	Bone-meal, 240 lbs.	6 0 0	2,631	32 14 3	
	Field 2.				
1	Cowdung, 120 bags	3 12 0	3,372	42 4 6	
2	No manure	.....	2,140	26 12 0	
3	Oilcake, 131½ lbs.	2 1 0	3,304½	41 5 0	
	Field 3.				
1	No manure	.....	2,304	28 13 0	
2	Oilcake, 172½ lbs.	2 14 0	2,947	36 13 6	
	Field 4.				
1	No manure	.....	660	8 4 0	
2	Bone-meal, 240 lbs.	6 0 0	1,172	14 10 6	
	Field 5.				
1	No manure	.....	1,302	16 4 6	
2	Bone-meal, 240 lbs.	6 0 0	1,668	20 13 6	

The difference in the yield between the manured and the unmanured plots would have been much greater but for the circumstance that all through August the rainfall was scanty, whilst the rainfall in September was much above the average, and this injured the manured plots which were in ear at the time. The unmanured plots, on the other hand, which were very backward, and had not yet put forth blossom, were much benefited by the copious and abnormal rainfall of September. This incident, as Mr. Sen remarks, shows that agricultural experiments must, before anything like positive conclusions can be arrived at from them, be continued for years in order to eliminate the effects of the accidents of season, &c.

2.—*Ginger.*

	Manures used per acre.	Price of manures.	Outturn per acre.	Money value of the outturn.
	lbs.	Rs. A. P.	lbs.	Rs. A. P.
(1) Bone-meal ...	... 84	2 1 6	1,260	31 8 0
(2) Oilcake ...	... 126	1 15 6	690	17 4 0
(3) No manure ...	... ...	.....	1,008	25 3 3

3.—*Brinjal.*

(1) Castor oil cake	... 240	3 12 0	4,428	69 3 0
(2) Mustard cake	... 264	4 2 0	4,512	70 8 0
(3) Bone-meal ...	... 240	6 0 0	3,492	54 11 0
(4) No manure ...	... ...	.....	2,364	36 15 0

4.—*Fodder grasses.*

	Yield per acre in lbs.	
	Last year.	Present year.
	lbs.	lbs.
(1) Yellow cholum	15,240	23,256
(2) Sorghum	44 280	23,076
(3) Reana luxurans	11,832	5,720
(4) Loari ghas (Andropogon bladhu Roxb.)	.....	6,720

36. Sorghum as a rain crop has succeeded well at the Burdwan farm, but it is found that it is not worth while to take a second or third cutting, for the

outturn from these cuttings is very insignificant. Yellow cholum gave little better outturn than sorghum; but in speaking of the comparative meris of these grasses, both of which make excellent fodder, it must be remembered that sorghum contains much more sugar than yellow cholum, and that while sorghum is eaten by cattle down to the roots, the lower portion of the stem of yellow cholum is too woody to form cattle food. As in the previous year, reana, which has been so highly spoken of, did not succeed in Burdwan. The seed of the loari ghas was brought by Mr. Sen from the interior of Beerbhoom. The outturn given does not at all represent the normal yield of this grass, which forms excellent cattle food. Some of the seed failed to germinate, and the plants that came up did not cover half the area sown. So far as can be judged from its look and texture, this grass is also likely to prove very valuable thatching and paper-making material.

5.—*Cotton.*

37. Eight different varities of cotton were experimented upon. The plots were manured with bone-meal at the rate of 1,080 lbs. per acre—

	Name of the variety.	Yield per acre.
		lbs.
1.	Nankin	370½
2.	Deba Lonacinu	97½
3.	Lonacinu	468
4.	Kapasia	156
5.	Upland	136½
6.	New Orleans	156
7.	Hill Tipperah } Failed to germinate.	
8.	Garo Hills }	

38. It will be noticed that, unlike previous experiments in Burdwan and unlike experiments made in other districts, very good results were obtained with Nankin cotton this year in the Burdwan farm. The plants look quite healthy, and proved more hardy than any other varieties experimented upon. They have put forth new shoots and leaves, and a second crop is expected. Experiments on the cultivation Nankin cotton were also tried in Mozufferpore and Hill Tipperah, but without success. Mr. Sen at first tried Nankin cotton as a winter crop, and as such it did not germinate; but planted in the beginning of the rainy season, in drills 30 inches apart, and manured with bone-meal, Nankin cotton, as the figures quoted above show, gave very good results. I do not, however, think it will ever be extensively grown in Bengal.

6.—*Effect of bone-meal on gram.*

		Manures used per acre.	Price of manure.	Outturn per acre	Money value of the outturn.
		lbs.	Rs.	lbs.	Rs. A. P.
(1)	Bone-meal ...	120	3	833	15 6 0
(2)	No manure ...	..	...	556⅔	10 5 0

7.—*Turmeric.*

		lbs.	Rs. A. P.	lbs.	Rs. A. P.
(1)	Bone powder ...	300	7 8 0	5,850	45 11 3
(2)	No manure ...	...	.....	4,900	38 1 6

8.—*Ground nuts.*

Cost of cultivation per acre.	Yield per acre.	Money value of yield.	Net profit per acre.
Rs. A. P.	lbs.	Rs. A. P.	Rs. A. P.
86 1 6	2,585½	129 4 6	43 3 0

9.—*Sugarcane.*

39. Much time and care were bestowed on sugarcane experiments in the Burdwan farm, as this crop forms one of the most important products of the Division; but so much injury was done to the plants at the first stage by white-ants, with which the whole farm and its neighbourhood abound, owing probably to the place having remained uncultivated and overgrown with weeds for years, that no stress can be laid on the figures given below as a criterion of the relative values of the various manures used. The results prove, however,

that the cultivation of sugarcane without manure on soils similar to that of the farm will entail loss:—

Manures used per acre in lbs.		Price of manures.	Weight of canes.	Weight of juice per acre.	Weight of gur per acre.	Price of gur.	Remarks.
	lbs.	Rs. A. P.	lbs.	lbs.	lbs.	Rs. A. P.	
1. Super	528	33 6 0	28,848	17,472	4,536	226 12 9	
Saltpetre	180						
2. Mustard cake	1,200	37 8 0	28,916	18,672	4,872	243 9 9	
Castor cake	1,200						
3. Super	528	33 6 0	20,892	13,296	3,300	115 0 0	
Saltpetre	180						
4. Mustard cake	1,200	37 8 0	18,242	10,800	2,880	144 0 0	
Castor cake	1,200						
5. Super	528	33 6 0	18,216	10,944	2,316	115 12 9	
Saltpetre	180						
6. Bone-meal	576	31 4 6	16,920	8,760	2,580	129 0 0	
Saltpetre	180						
7. Bone powder	120	19 14 0	10,080	7,474	1,506	75 5 0	
Saltpetre	180						
8. Oilcake	2,400	37 8 0	12,840	8,316	1,740	87 0 0	
9. Oilcake	2,400	37 8 0	13,500	6,372	1,560	78 0 0	
10. Super	600	32 13 0	21,390	13,050	3,420	171 0 0	
Oilcake	900						
11. Oilcake	3,360	52 8 0	40,008	26,424	6,864	343 3 3	
12. Super	720	47 6 0	23,628	15,000	3,744	187 3 3	
Saltpetre	252						
Gypsum	240						
13. Saltpetre	252	39 14 0	21,984	14,724	3,792	189 10 6	
Bone-meal	600						
Gypsum	240						
14. No manure	...	.....	2,496	1,440	312	15 10 6	

40. *Gur-making.*—Taking up the suggestion made by him in his last annual report, Mr. Sen imported from Beheea two mills, a pair of boiling pans one centrifugal sugar-dryer, and a competent man to make gur. The gur made at the farm has been pronounced by cultivators and tradesmen, as well as by the consumers of it, to be far superior to what can be had in the Burdwan Division, but the price realized for it is not proportionately high.

Mr. Sen is of opinion that the centrifugal sugar-dryer, invented by Messrs. Mylne and Thompson of Beheea, which has been so highly spoken of in some quarters, is not at present likely to come into general use in Bengal, the tendency in Bengal being, he says, towards an increasing consumption of refined sugar and not towards consumption of brown, coarse sugar such as is turned out by the dryer.

10.—*Potatoes.*

41. (*a*) *Manure Experiments.*—The same variety of potatoes, namely, the acclimatised *magnum bonum*, was experimented upon in different plots in order to ascertain the relative values of various manures. The several plots were manured differently, but in other respects received the same treatment :—

Manures used per acre.		Price of manures.	Outturn per acre.	Remarks.
	lbs.	Rs. A. P.	lbs.	
1 Oilcake	960	15 0 0	4,960	
2 Bone-meal	480	27 0 0	8,960	
Oilcake	960			
3 No manure	...	.....	3,040	
4 Bone-meal	960	24 0 0	7,200	
5 Oilcake	1,920	30 0 0	5,440	
6 Super	120	15 0 0	7,680	
Saltpetre	120			
7 Super	81	20 4 0	9,280	
Saltpetre	90			
Bone-meal	360			
8 Bone-meal	480	19 8 0	10,400	
Oilcake	480			

Positive conclusions cannot be come to from the experiments of a year or two; but so far as these experiments go, they show the great value of bone-meal as a manure for potatoes. Bone-meal, costing Rs. 24 per acre, has given an increase of yield of 4,160lbs, or fifty-one maunds per acre, which, valued at the very moderate rate of Rs. 1-8 per maund, would represent a profit of Rs. 75-8 per acre, whether used singly or mixed with other manures. So far as could be judged from the appearance of the plants, the oilcake plot

was best; but when the crop was raised, it was found that the growth of the tubers had not been as good as the appearance of the stalks would indicate. It is to be noticed that the addition of bone-meal increased the yield of even the superphosphate plot. These results were not quite unexpected, for they are known to the most advanced growers of potatoes in England. But what is the most unexpected and noticeable feature of these experiments is the fact that, whereas the tubers of plots receiving bone-meal as manure, either singly or mixed with other manures, were quite free from disease, the potatoes of other plots, though placed side by side with the former, in some cases even intervening with them, were more or less diseased. The plots were all planted on the same day from the same supply of seed.

42. (*b*).—*Different varieties of potatoes under the same treatment.*

	Varieties.	Outturn per acre.
		lbs.
1.	*Magnum bonum* acclimatized	3,320
2.	Country	2,760
3.	Darjeeling hill	4,440
4.	Naini Tal hill	4,020

Experiments made at the Burdwan farm, as well as in Government and other estates, have proved that by the use of English potato seed, either imported directly from England or acclimatized in hill stations, a crop heavier in quantity and better in quality can be obtained than is possible with the ordinary country seed. At the last potato-growing season, a considerable demand for English potato seed sprung up in the Burdwan Division as well as elsewhere, in consequence of experience of results of experiments made with this seed under Mr. Sen's instructions in the previous year, but the supply fell short of the demand. To supply potato cultivators of the plains with seed of better quality than is ordinarily available, Mr. Sen has suggested the establishment of a farm in the Darjeeling hills for the cultivation of potatoes from seeds imported from England. He has now been instructed to proceed to Darjeeling and report if anything can be done to supply this want, and at the same time to enquire into the spread of disease which is causing great loss to potato-growers in the Darjeeling hills.

Dumraon Experimental Station.

43. In the experimental station attached to the home farm of the Maharajah of Dumraon, experiments were made with paddy, wheat, and sugarcane. These crops were grown in parallel plots treated differently as regards seeds, mode of cultivation and manuring, and the outturn of each plot was accurately noted in order to ascertain comparative results. There were 24 plots under experiment in 1885-86, and 15 plots were added last year. Of these 39 plots, 14 were under paddy, 4 under sugarcane, and the rest under wheat. Besides these, there were 7 plots under experiment in Bhojpur.

Statement showing Treatment and Results of the experimental plots sown with Paddy.

Number of plot.	Treatment.	Produce per acre.	
		Grain.	Straw.
		lbs.	lbs.
1A	Deep ploughed	650	1,681
1B	Shallow ploughed	556	911
2A	Manured with cowdng at the rate of 180 maunds per acre ...	665	1,228
2B	Unmanured	571	1,061
3A	Manured with sweepings at 180 maunds per acre	674	1,195
3B	Unmanured	605	1,195
4A	Manured with crude saltpetre at 3 maunds per acre ...	856	1,533
4B	Unmanured	493	961
4C	Sown after plough	526	928
7A	Manured with crude saltpetre and transplanted with seedlings...	971	1,851
7B	Unmanured and transplanted with seedlings	505	928
8A	Manured with crude saltpetre at 3 maunds per acre and lime at 9 maunds per acre.	1,191	2,399
8B	Manured with cowdung at 18 maunds per acre and lime 9 maunds per acre.	744	1,258
8C	Manured with lime only	514	934

As in the previous year, all the plots which received special treatment gave an increased yield over plots treated in the ordinary way. The plot manured with crude saltpetre and lime gave the largest outturn. A comparison of plot 7A with 4A shows the advantage of transplanting seedlings over broadcasting. Deep ploughing gave an increase over shallow ploughing, but it is to be observed that the increase is far greater in straw than in grain.

44. *Sugarcane Experiments.*

Number of plot.	Area in square yards.	Treatment.	Outturn per acre.	
			Sugar.	Jagri.
			lbs.	lbs.
6A	1,350	Planted out in trenches and manured with crude saltpetre.	1,100·65	828·2
6B	1,600	Unmanured and planted in trenches	505·1	1,004·3
9A	.. ...	Manured with crude saltpetre and sown in the native way.	1,228·1	553·6
9B	.....	Sown in the native way and unmanured ...	535·4	704·9

In the case of sugarcane, as in that of paddy, the use of crude saltpetre as a manure gave an enormously increased yield ; but the net profit resulting from the special treatment cannot be stated. The variety planted was that locally known as mungo, and cultivation according to the Mauritius system, recommended by Messrs. Mylne and Thompson, gave better results than the native method and is less expensive.

45. *Wheat*, 1886-87.

No. of plot.	Area in square yards.	Kind of wheat.	Treatment.	Outturn per acre.	
				Grain.	Straw.
5A	1,600	Local red ...	Deep-ploughed	529·4	804·6
5B	.....	.....	Shallow-ploughed	420·5	680·6
10A	.....	Dumraon prize wheat	Watered from well	843·9	992·2
10B	.....	.....	„ „ canal	659·4	928·6
11A	800	Mozuffernagur ...	Green manured with hemp in 1885-86	592 9	992·2
11B	.....	.....	Ditto ditto 1886-87	810·7	1,113·2
12A	1,600	.....	Manured with ashes	804·6	937·7
12B	.....	.....	„ ashes and crude saltpetre ...	974·05	1,052·7
12C	.....	Local wheat ...	„ with cowdung	611·05	744·1
12D	.....	.....	„ bones	568·7	686·8
12E	.....	Buxar	„ with crude saltpetre ...	1,512·5	1,984·4
12F	.....	.....	Unmanured	517·3	556 6
13*a*	.....	Mozuffernagur ...	Shallow-ploughed	789 5	928·6
13*b*	.....	Local red ...	Ditto	623·1	744·1
14A	400	Mozuffernagur ...	Manured with lime	713·9	763·1
14B	.....	.....	Ditto and crude saltpetre	1,355·5	1,234·2
14C	.....	Buxar	Ditto	713·9	871·2
14D	.....	.....	Ditto and crude saltpetre	103·5	992·2
14E	.....	Local	Ditto ditto ...	1,173·7	2,480·5
14F	.....	.....	Manured with lime	580·8	738·1
15	1,200	Mozuffernagar ...	Ditto with crude saltpetre ...	1,028·5	1,443·9

Bhojpore Farm.

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No.
	Country maize.	Canada corn.	Mozuffernagur wheat.	Mozuffernagur wheat.	Buxar white wheat.	Buxar white wheat.
Treatment.	*Treatment.*	*Treatment.*	*Treatment.*	*Treatment.*	*Treatment.*	*Treatment.*
Unmanured and sown with Sorghum.	Unmanured.	Unmanured.	Unmanured.	Saltpetre ... 20 seers	Unmanured.	Saltpetre .. 20 seers
Outturn.	*Outturn.*	*Outturn.*	*Outturn.*	*Outturn.*	*Outturn.*	*Outturn.*
1886-87.	1886-87.	1886-87.	1886-87.	1886-87	1886-87.	1886-87.
Grain ... 10lbs.	Grain ... 191lbs.	Grain ... 10lbs.	Grain ... 334lbs.	Grain ... 303lbs.	Grain ... 321lbs.	Grain ... 332lbs.
Stalks ... 1,921 „	Stalks ... 776 „	Stalks ... 57 „	Straw ... 410 „	Straw ... 507 „	Straw ... 390 „	Straw ... 572 „

The average outturn of wheat over the whole farm was last year 913·7lb. per acre, which is 471·7lb. less than the average outturn of the preceding year.

The season was extremely unfavourable to wheat on this farm. In the first place rainfall was abnormally heavy at sowing time and continued late, and the land could not be ploughed more than two or three times, while in the preceding year it was ploughed five or six times; *secondly*, the crop, when it was coming into flower, was affected with rust or harda, which rendered the grain light and ears thin; and, *thirdly*, when the crop was ready for cutting, a heavy fall of rain and hailstones destroyed about one-fourth of the produce. It will be observed that, as in the previous year, crude saltpetre, applied as a manure at the rate of three maunds per acre and costing Rs. 14-1, gave an increased yield of 12 maunds valued at Rs. 29 per acre.

46. The following statement shows the results of experiments made at Bhagulpore by Mr. Hossein:—

Table showing Results of Experiments with Manures in Cantonment grounds in Bhagulpore.

1	2	3	4	5		6		7
Name of plot.	Area in square yards.	Name of crop or crops grown.	Treatment.	Outturn per plot in lbs.		Outturn per acre in maunds and seers.		Remarks.
				Grain.	Straw.	Grain.	Straw.	
						Mds. Srs.	Mds. Srs.	
A	1,600	1. Gram (bunt) ... ... 2. Linseed (chikna)	Bone-meal applied	344 270 14		13 0 0 21	10 8	One maund bone-meal, price Rs. 2.
a	.....	1. Gram (bunt) ... ... 2. Linseed (chikna)	No manure	218 200 17		8 10 0 25½	7 22½	
B	.....	1. Gram (bunt) ... ... 2. Linseed (chikna) ... ... 3. Mustard (gota)	Oilcake applied ...	415 286 12 ..... 13		18 27½ 0 18 0 19½	10 32½	Oil cake, 30 seers.
b	.....	1. Gram (bunt) ... ... 2. Linseed (chikna) ... ... 3. Mustard (gota)	No manure	295 230 14 ..... 20		11 6 0 21 0 30	8 27½	
C	.....	1. Gram (bunt) ... ... 2. Local wheat	Ploughed in green hemp.	445 520		16 33	19 26½	Sown, reaped, and mixed together as is usual in this part.
c	.....	1. Gram (bunt) ... ... 2. Local wheat	No manure	340 370		12 34	13 39½	Ditto ditto.
D	.....	1. Gram (bunt) ... ... 2. Linseed (chikna) ... ... 3. Mustard (gota)	Bone-meal applied	377 240 12½ 15		14 5 0 19 0 22½	11 23½	Bone-meal, 2 maunds.
d	.....	1. Gram (bunt) ... ... 2. Linseed (chikna) ... ... 3. Mustard (gota)	No manure	359 250 14 ..... 9		12 32½ 0 21 0 13½	9 18	
e	.....	1. Buxar wheat	Oilcake applied ...	93 148		3 20½	5 23½	Oilcake, 30 seers.
f	.....	1. Ditto	No manure	105 160		3 38½	6 2	
g	.....	1. Ditto	Bone-meal applied	133 180		5 1	6 32	Bone-meal, 1 maund.

The land on which these experiments were made in Bhagulpore is not typical of the district, and they will now be discontinued.

Experiments made through ryots and zemindars.

47. As in the preceding year, a number of experiments to test the effect of different manures on some of the most important crops of the Burdwan Division were conducted by Mr. A. C. Sen through ryots and talukdars. Experiments were also made to ascertain what the possibility may be of successfully cultivating English potatoes in the plains of Bengal. Mr. Sen has always been of opinion that experiments capable of yielding scientifically accurate results, and on which general conclusions may be safely based, cannot be made through either ryots or zemindars. And the results of his second year's experiments have served only to confirm his belief. The following statement shows the reported

results of experiments made in this way, but the figures cannot be accepted with confidence :—

(1) *Experiments to test the value of Bone-meal and other manures on Paddy.*

Localities.	Manure used per acre in lb.	lb.	Price of manures. Rs. A. P.	Outturn per acre. lb.	Money value of the outturn. Rs. A. P.	Remarks.
Nandingram ...	1 Oilcake	360	6 3 0	2,640	33 0 0	
	2 Bone-meal	240	6 0 0	4,800	60 0 0	
	3 Super	90	4 5 0	4,800	60 0 0	
	3 Saltpetre	15				
	4 Super	90	4 5 0	2,880	36 0 0	
	4 Saltpetre	15				
Khanyan	1 Bone-meal	240	6 0 0	2,400	30 0 0	
	2 Oilcake	180	6 3 0	2,880	36 0 0	
	2 Bone-meal	120				
	3 Super	120	6 7 6	3,240	40 8 0	
	3 Saltpetre	30				
	4 Oilcake	180	5 3 9	2,400	30 0 0	
	4 Super	60				
	5 Bone-meal	180	4 12 3	1,800	22 8 0	
	5 Hide salt	45				
	6 Bone-meal	160	6 5 6	2,800	35 0 0	
	6 Saltpetre	30				
	7 Oilcake	144	4 3 6	2,400	30 0 0	
	7 Super	48				
	8 Bone-meal	200	5 11 3	3,200	40 0 0	
	8 Hide salt	30				
Hargram	1 Bone-meal	240	6 0 0	1,440	18 0 0	
	2 Oilcake	360	5 10 0	2,440	28 0 0	
	3 Dung	4,800	3 12 0	1,600	20 0 0	
	4 No manure	...	.....	1,440	18 0 0	
	5 Oilcake	360	5 10 0	2,160	27 0 0	
	6 Bone-meal	180	7 14 0	1,920	24 0 0	
	6 Saltpetre	36				
	7 Super	144	7 14 0	2,880	36 0 0	
	7 Saltpetre	36				
	8 Oilcake	180	4 8 0	1,680	21 0 0	
	8 Bone-meal	72				
	9 Oilcake	360	5 10 0	2,160	27 0 0	
	10 Bone-meal	180	7 14 0	1,920	24 0 0	
	10 Saltpetre	36				
	11 Super	144	7 14 0	2,880	36 0 0	
	11 Saltpetre	36				
	12 Oilcake	180	4 8 0	1,680	21 0 0	
	12 Bone-meal	72				
Moynah	1 Oilcake	360	5 10 0	1,200	15 0 0	
	2 Bone-meal	240	6 0 0	1,440	18 0 0	
	3 Bone-meal	120	4 11 0	1,080	13 8 0	
	3 Saltpetre	18				
	4 Super	100	5 0 0	1,200	15 0 0	
	4 Saltpetre	20				
Nabagram ...	1 Super	180	8 7 0	480	6 0 0	
	1 Saltpetre	30				
	2 Bone-meal	180	7 5 0	384	4 13 6	
	2 Saltpetre	30				
	3 Oilcake	240	3 12 0	480	6 0 0	
Panduah ...	1 Bone-meal	240	6 0 0	2,400	30 0 0	
	2 Oilcake	360	5 10 0	2,400	30 0 0	
	3 Super	180	8 7 0	3,000	37 8 0	
	3 Saltpetre	30				
Jowgram ...	1 Bone-meal	240	6 0 0	1,200	15 0 0	
	2 Bone-meal	120	6 1 6	960	12 0 0	
	2 Oilcake	180				
Nawadia ...	1 Oilcake	360	5 10 0	2,700	33 12 0	
	2 Bone-meal	240	6 0 0	1,740	21 12 0	
	3 Super	180	8 5 6	2,520	31 8 0	
	3 Saltpetre	30				
Ajhapore ...	1 Bone-meal	225	5 14 0	1,200	15 0 0	
	2 Super	120	6 7 6	3,360	42 0 0	
	2 Saltpetre	30				
	3 Bone-meal	112½	5 10 0	1,980	24 12 0	
	3 Saltpetre	30				
	4 Super	180	5 10 0	2,670	33 6 0	
Government villages—						
(*a*) Belcooli—						
I	1 Dung	4,800	3 12 0	1,680	21 0 0	
	2 No manure	...	.....	1,200	15 0 0	
	3 Oilcake	480	7 8 0	1,800	22 8 0	
II	4 Oilcake	480	7 8 0	1,788	22 5 0	
	5 No manure	...	.....	1,140	14 4 0	
	6 Bone-meal	240	6 0 0	1,620	20 4 0	
III	7 Bone-meal	240	6 0 0	1,710	21 6 0	
	8 No manure	...	.....	1,140	14 4 0	
	9 Bone-meal	120	6 12 0	2,100	26 4 0	
	9 Oilcake	240				
IV	10 Bone-meal	240	6 0 0	1,680	21 0 0	
	11 No manure	...	.....	1,215	15 6 0	
	12 Bone-meal	180	12 0 0	1,980	24 12 0	
	12 Saltpetre	60				
(*a*) Belcooli V	13 Oilcake	480	7 8 0	1,680	21 0 0	
	14 No manure	...	.....	1,290	13 2 0	
	15 Super	240	13 8 0	2,340	29 4 0	
	15 Saltpetre	60				
(*b*) Pearapore I	1 Dung	4,800	3 12 0	1,560	19 8 0	
	2 No manure	...	.....	1,140	14 4 0	
	3 Oilcake	480	7 8 0	1,752	21 14 6	
II	4 Oilcake	480	7 8 0	1,740	21 12 0	
	5 No manure	...	.....	960	12 0 0	
	6 Bone-meal	240	6 0 0	1,530	19 2 0	
III	7 Bone-meal	24	6 0 0	1,788	22 5 0	
	8 No manure	...	.....	1,200	15 0 0	
	9 Bone-meal	120	6 12 0	1,800	22 8 0	
	9 Oilcake	240				
IV	10 Bone-meal	240	6 0 0	1,740	21 12 0	
	11 No manure	...	.....	1,200	15 0 0	
	12 Bone-meal	18	12 0	1,920	24 0 0	
	12 Salpetre	60				

Localities.	Manures used per acre in ℔.		Price of manures.	Outturn per acre.	Money values of the outturn.	Remarks.
		℔.	Rs. A. P.	℔	Rs. A. P.	
V	13 Oilcake	480	7 8 0	1,800	22 8 0	
	14 No manure	...	.....	1,140	14 4 0	
	15 Super	240	13 8 0	2,496	31 3 3	
	15 Saltpetre	60				
(e) Moojpore I	1 Dung	4,800	3 12 0	1,680	21 0 0	
	2 No manure	...	.....	1,230	15 6 0	
	3 Oilcake	480	7 8 0	1,680	21 0 0	
II	4 Oilcake	480	7 8 0	1,710	21 6 0	
	5 No manure	...	.....	1,200	15 0 0	
	6 Bone-meal	240	6 0 0	1,710	21 6 0	
III	7 Bonemeal	240	6 0 0	1,530	19 2 0	
	8 No manure	...	.....	1,080	13 8 0	
	9 Bone-meal	120	6 12 0	1,680	21 0 0	
	9 Oilca-ke	240				
IV	10 Bonemeal	240	6 0 0	1,800	22 8 0	
	11 Unmanured	...	.....	960	12 0 0	
	12 Bone-meal	180	12 0 0	1,860	23 4 0	
	12 Salpetre	60				
	13 Oilcake	480	7 8 0	1,860	23 4 0	
	14 No manure	...	.....	1,560	19 8 0	
	15 Super	240	13 8 0	2,910	36 6 0	
	15 Saltpetre	60				
(d) Peasara—						
I	1 Dung	4,800	3 12 0	1,320	16 8 0	
	2 No manure	...	.....	960	12 0 0	
	3 Oilcake	480	7 8 0	1,710	21 6 0	
II	4 Oilcake	480	7 8 0	1,722	21 8 3	
	5 No manure	...	.....	1,050	13 2 0	
	6 Bone-meal	240	6 0 0	1,680	21 0 0	
III	7 Bone-meal	240	6 0 0	1,692	21 2 6	
	8 No manure	...	.....	1,200	15 0 0	
	9 Bonemeal	120	6 12 0	1,680	21 0 0	
	9 Oilcake	240				
IV	10 Bonemeal	240	6 0 0	1,560	19 8 0	
	11 No manure	...	.....	1,140	14 4 0	
	12 Bone-meal	180	12 0 0	1,800	22 8 0	
	12 Saltpetre	60				
V	13 Oilcake	480	7 8 0	1,620	20 4 0	
	14 No manure	...	.....	1,440	18 0 0	
	15 Super	240	18 8 0	2,442	30 8 6	
	15 Saltpetre	60				

48. It will be noticed that bone-meal proved to be a very good manure when applied to paddy. But this is shown not so much by the figures given above as by the steadily increasing demand for this manure in villages where it was used in the preceding year, and this notwithstanding the strong aversion to the introduction of it expressed in some of the vernacular newspapers. Mr. Sen reports that he could have introduced this manure to almost any extent among the cultivators of the Burdwan Division, but for the fact that the price demanded by the Bally and other factories is somewhat higher than is paid for oilcake. It is now intended to make an experiment with fermented bones, to see if the price can be reduced. But it is unlikely that Indian ryots, generally speaking, will take the trouble to collect and ferment bones for themselves. If bone manure so treated is to take the place of bone-meal, there must be a special agency to ferment and grind bones on a large scale, and then sell them in the same way as bone-meal is now being sold.

49. Under special conditions a mixture of superphosphate of lime and crude saltpetre may with great advantage be applied to paddy as a topdressing; but so long as sulphuric acid sells at its present extremely high price in India, there is not much chance of super coming into general use. The highness of the price of sulphuric acid is more to be regetted for, as will be seen afterwards, super has proved an excellent manure for sugarcane on strong clay land. It is satisfactory to note that Mr. Sen sold during the period under report more than 100 maunds of bone-meal to ryots of the villages in which he had distributed small qualities of it *gratis* during the previous year, and the ryots of these villages are now keenly interested in watching the results of the use of this manure. It is with a view to enable them in this way to judge for themselves, and not for the purpose of obtaining accurate statistical results, that I have advocated, through the agency of ryots and zemindars

themselves, the conduct on a small and inexpensive scale, of such well-considered experiments as are likely to show profitable results.

50. 2.—*Results of Sugarcane Experiments.*

Localities.	Manures used per acre.		Price of manures.	Outturn per acre.	Money value of the outturn.	Remarks.
		lbs.	Rs. A. P.		Rs. A. P.	
Burrakar ...	1 Oilcake	2,400	37 8 0	4,800 lbs.	.....	
	2 Super	528				
	Saltpetre	180	36 6 0	7,200		
	Lime	480				
	3 Oilcake	960	27 0 0	Destroyed by flood.	360 0 0	The land is strong clay.
	Bone-meal	480				
	4 No manure	...	.....	Ditto.		
Government villages—						
(a) Belcooli ...	A. Oilcake	2,400	37 8 0			
	B. Super	528				
	Saltpetre	180	34 14 0	Average of all plots, 3,840 lbs.	192 0 0	Through the neglect of the tehsildar, who was put in charge of these experiments, the results have not been properly recorded.
	Gypsum	360				
	C. Bone-meal	600				
	Ashes	480	18 0 0			
	Gypsum	240				
	D. Bone-meal	600				
	Saltpetre	180	34 2 0			
	Gypsum	360				
(b) Moojpore ...	A. Oilcake	2,400	37 8 0	Average of all plots, 5,280 lbs.	264 0 0	
	B. Super	528				
	Saltpetre	180	34 14 0			
	Gypsum	240				
	C. Bone-meal	600				
	Ashes	480	18 0 0	Average of all plots, 5,280 lbs.	264 0 0	
	Gypsum	240				
	D. Bone-meal	600				
	Saltpetre	180	34 2 0			
	Gypsum	360				
(c) Navina ...	A. Oilcake	2,400	37 8 0			
	B. Super	528				
	Saltpetre	180	34 14 0			
	Gypsum	360				
	C. Bone-meal	600				
	Ashes	480	18 0 0	Average of all plots, 2,880 lbs.	140 0 0	
	Gypsum	240				
	D. Bone-meal	600				
	Saltpetre	180	34 2 0			
	Gypsum	360				
(d) Pearapore ...	A. Oilcake	2,400	37 8 0			
	B. Super	528				
	Saltpetre	180	34 14 0			
	Gypsum	360				
	C. Bone-meal	600				
	Ashes	480	18 0 0	Average of all plots, 4,800 lbs.	240 0 0	
	Gypsum	240				
	D. Bone-meal	600				
	Saltpetre	180	34 2 0			
	Gypsum	360				

51. *Potato Experiments made by Ryots in Government villages.*

The variety experimented upon was acclimatized *magnum bonum.*

Name of the village.	Yield per acre.	The average yield of country potatoes is.
	lbs.	lbs.
Belcooli	9,600	9,600
Moojpore	14,400	
Nabina	30,000	
Peasarah	9,600	
Burdwan.		
Through a talukdar	16,800	.....

52. *Experiments made through Ryots and Zemindars in Bhagulpore. Introduction of Buxar wheat.*

Experiments were also made by Mr. Hosein with Buxar wheat through zemindars and others, with a view to introduce this variety of wheat into the Bhagulpore Division. It was stated in the last year's report that Buxar seed sown in Bhagulpore yielded a grain described by the Committee of the Wheat and Trades Association to be a 'splendid description of wheat, soft, mellow, bold, regular and of good colour, and six annas a maund superior in value to the local Bhagulpore grain.' This led many zemindars and others to apply for this variety of wheat for experimental cultivation. One substantial cultivator alone applied at first for 15 maunds of seeds, and later on for 50 maunds more, and some Rajput cultivators in Monghyr applied for 135 maunds of this seed, and were supplied with it at their own expense. Samples of wheat thus grown in Bhagulpore and Monghyr were sent for appraisement to the Wheat and Trades

Association, and have been found to be superior to that locally grown, though not of so high quality as that obtained last year in Bhagulpore. As regards this difference in the results of the two years, it should be remarked that the Wheat and Trades Association report that, owing to unfavourable rainfall, there was a general falling off in the quality of wheat grown throughout the Bhagulpore Division last cold season. One of the zemindars who imported Buxar seed into Bhagulpore was so well satisfied with the results that he will now grow no other, and, as Mr. Hossein informs me, has expressed a desire to import 500 maunds more of it for seed this year. The experimental cultivation of Buxar wheat was also tried in other districts, but not with so much success as in Bhagulpore, and applications for further supplies of it are now being received.

FIBRES.

53. It was stated in my last annual report that, at the request of the Government of India, the Agri-Horticultural Society of India conducted certain experiments in the cultivation of rhea and other fibre plants and in extraction of fibre, with a view to ascertain the relative merits, the cost of cultivation, and what possibility there may be of growing them as commercial products. The Society have since submitted their final report.

The experiments were continued for two years, and the fibre-bearing plants experimented upon were the following—

(1) Hibiscus esculentus.
(2) Hibiscus abelmoschus.
(3) Abutilon indicum.
(4) Bœhmeria nivea.
(5) Sida rhombifolia.
(6) Abroma augusta.
(7) Sansivera zeylanica.
(8) Musa paradisica.

Of the above, the first and the eighth gave good crops, Hibiscus abelmoschus being specially good. The Sida grew rather branchy and tangled. Hibiscus esculentus, Abutilon indicum, and Bœhmeria nivea were thin in low-lying places.

The Sansivera zeylanica made little or no progress, showing the uselessness of cultivating it in an open and unsheltered position; it is likely to do better in shady places.

For the extraction of fibres a Death and Ellwood machine alone was used in the first as well as the second trial. This machine was found totally unsuited for dealing with some of the fibres. The results of the trial with this machine are given in the following tables:—

Trials with Death and Ellwood's Machine.

Name of Plant.		Area from which cut, sq. feet.	Green plant, lbs.	Dry fibre, lbs.	Percentage of fibre.
Botanical.	Vernacular.				
Hibiscus abelmoschus (musk mallow)	Kasturi ...	300	456	6	1·31
Abutilon Indicum	Petári ...	2,574	265	8	3·01
Hibiscus esculentus	Dheros ...	11,657	1,194	22½	1·88
Sansiviera Zeylanica	Múrva ...	1,330	380	1½	39
Musa paradisica (plantain)	Kach-kela ...	.....	436	3	·68
Pineapple	.....	.....	158	1	·63
Bœhmeria nivea (Rhea) imperfectly cleaned. Great waste.					
Sida rhombifolia (*Barela*) could not be cleaned with machine.					

From the foregoing data, the following may be given as the yield of fibre per acre of the different plants treated with a Death and Ellwood machine.

Yield per acre, fibre extracted with a Death and Ellwood Machine.

		Md.	S'.	lbs.
Hibiscus abelmoschus	Kasturi ...	10	35	871
Abutilon Indicum	Petári ...	1	27½	135
Hibiscus esculentus	Dheros ...	1	2¼	84⅓
Sansiviera Zeylanica	Múrva ...	.....	24¾	49⅓

Some of the fibres were also extracted by the *retting* process, and the results of this process are collected in the following tables:—

Fibre prepared by the retting process.

	Area.	Plant.	Fibre.	Per cent.
	Sq. ft.	lbs.	lbs.	
Hibiscus abelmoschus	22,000	7,575	501½	6·61
Ditto after seeding	20,000	3,320	400	12·04
Abutilon Indicum	27,600	3.860	322	8·34
Hibiscus esculentus	3,640	2,581	43	1·66
Sida rhombifolia	10,400	2,560	105	4·10

According to these data, the yield per acre of fibre should be—

	Mds.	s.	c.
Hibiscus abelmoschus	12	17	0
Ditto seeded	10	35	8
Abutilon Indicum	6	14	0
Hibiscus esculentus	6	17	4
Sida rhombifolia	5	19	8

The following table compares the results of the *retting* process with that obtained with the Death and Ellwood machine:—

	Death and Ellwood Machine.	Retting.
	Maunds.	Maunds.
Hibiscus abelmoschus	10—35	12—17
Abutilon indicum	1—27½	6—14
Hibiscus esculentus	1—2¼	6—17—4

It will be seen that the *retting* process gave a better outturn.

The Society have arrived at the conclusion that the cultivation of Hibiscus, Abutilon, Sansivera and Sida has no advantage over that of jute.

From the above summary of the final report submitted by the Society, it appears that, though the experiments conducted by them have thrown considerable light on the question of the cultivation of some fibre-yielding plants, and the extraction of fibres generally, yet sufficiently accurate information has not yet been obtained on any of the three points which it was the object of these experiments to supply. In order to bring the questions under consideration to a more crucial test, the land leased by the Society for the purpose of these experiments, together with the stock of Rhea, Sansivera and plantain trees upon it, has been handed over to Messrs. Ewing and Company, who have taken up the investigation as regards the most important of the fibres, viz. rhea, at their own cost, and have undertaken to report the results. If they find them to be satisfactory as they report to be likely, they will no doubt take up the question of manufacture of rhea as a Commercial product in a practical manner.

Another experiment in the same direction is being tried by Mr. Maries of Durbhunga, who, it is believed, has satisfied himself that a process discovered by him for the extraction and cleaning of rhea fibre can be worked at a profit.

Cost of agricultaral inquiry improvement and experiments.

54. The total nett cost to Government of expenditure on agricultural inquiry, experiment, improvement, agricultural implements and distribution of seed, apart from cost of establishment and of what has been done at the expense of private individuals, amounts only to Rs. 6,860.

Chapter VI.—Cattle-breeding and Veterinary Establishments.

55. Mention was made in my first annual report of the fact that, pending completion of arrangements for the Provincial Contract, it was found necessary by the Government of India, for financial reasons, to refuse its sanction to a scheme which had been prepared for the establishment of a veterinary school in Bengal. The terms of the Provincial Contract may have since been settled,

but in the present state of the Bengal finances it is believed that it would be useless to re-open this question. Nothing therefore has been done, and nothing seems to be at present possible in the matter of opening the proposed veterinary school, or of providing an agency for treatment of disease among cattle. This department cannot, under these circumstances, do anything towards the prevention or cure of disease among cattle of which outbreaks are now being constantly reported by local officers.

Two Hissar bulls were supplied for use on the Government estates in Arrah and Sasseram, and two half-bred English bulls were presented to Government by Dr. Greenhill. Of these, one, out of a fine country cow by Zooloo, an imported Jersey bull, has been made over to the Manager of the Burdwan Raj, and the other, out of a fine Hansy cow by an imported Durham bull was given to the Arrah Municipality, that body having undertaken to provide for the maintenance and custody of the animal, and to report through their Chairman whether any improvement in the local breed of cattle may be effected by means of it. These are but isolated and insignificant efforts, but to anybody who is acquainted with the improvement effected by Mr. Taylor, when Commissioner of Patna, in the breed of cattle in that locality by the introduction of one or two English bulls—an improvement which is visibly marked up to this day—it will be apparent that even isolated efforts of this kind may effect some good, and if other municipalities and public bodies would follow the example set by the Arrah Municipality, and would interest themselves in seizing and weeding out such of those wretched country bulls as are diseased, and now roam about spreading disease wherever they go, and if they would keep for public use, in local pounds or elsewhere, a suitable and superior class of sires, which might be procured for them at their expense by Government, much might be effected towards improving the breed of cattle in these Provinces, without entailing any expenditure on the State. But if the more enlightened and representative portion of the community will take no interest in this, or similarly important questions, and if something of the kind cannot be done, I am unable to see how the Agricultural Department, as at present constituted, can do anything substantial towards improving the breed of cattle in Bengal.

Chapter VII.—Agricultural and Financial Statistics.

56. A special report has been submitted on the subject of the collection of agricultural statistics in Bengal, and is now awaiting orders of Government.

Price-lists under the Tenancy Act.

57. A special report has also been submitted on the subject of preparation both of price-lists under the Tenancy Act and of the fortnightly return of prices-current of food-grains. Enquiries made in connection with the preparation of price-lists under the Tenancy Act have shown that great diversity of practice, and much laxity of procedure, exist in the preparation of the fortnightly returns of prices of food-grains now published in Gazette. Suggestions for introduction of greater uniformity in the preparation of the returns, and for securing greater accuracy in the entries contained in them, have been made, and are now under consideration of Government.

Price-lists prepared under the Tenancy Act rules for the half-year ending December 1886 were submitted, and those for the half-year ending June 1887 also will soon be ready for publication.

Chapter VIII.—Trade and Trade Statistics.

58. Trade statistics are compiled in the Revenue and General Departments of the Bengal, Secretariat.

Chapter IX.—Miscellaneous.

Agricultural Exhibition.

59. In the Resolution on the first Annual Report of the Agricultural Department, it was remarked that Sir Rivers Thompson hoped to be able to attend

the Show which was to be held at Doomraon in February following, and to judge as to the utility of what, under the auspices of the Maharajah of Doomraon, promised to become an annual institution. Sir Rivers Thompson accordingly visited Doomraon in February and opened the Show held on that occasion, and I believe pronounced it to be a successful and useful institution.

The different sections in which exhibits were received, considering that the Show was merely one of a local character, were all well represented. The various implements invented in recent years with a view to meet the requirements of Indian agriculturists were exhibited, ploughing matches were held, and water-lifts and other machines were shown at actual work.

Some very fine specimens of wheat, barley, rice and millets were exhibited, for which, it may be mentioned, the first prizes were awarded to ryots of the Doomraon Raj, and of the Sasseram Government estates.

Ploughs and water-lifts were sold at the Show.

60. Though this Doomraon Exhibition promised to be a useful and permanent institution, yet as Mr. Allen, the Special Agricultural Officer of Patna, and Mr. Jenkins, the Sub-divisional Officer of Buxar, who, co-operating with Mr. Allen, had acquired much experience in the conduct of these Shows and in the supervision of the agricultural experiments hitherto made at Doomraon, have both of them been transferred, and as there is no officer now left in the Patna Division who can give close personal attention to these matters, or is possessed of the knowledge required for the intelligent and careful conduct of agricultural experiments, I doubt whether it will be possible to continue with advantage these experiments in the Doomraon farm, or whether the efforts hitherto made to excite interest in agricultural enquiry, and to introduce agricultural improvements in Shahabad, will be productive of the lasting beneficial results which I at one time anticipated from them. The experiments hitherto made at the Doomraon experimental station were designed, like Sir John Lawes' experiments in England, to afford data for arriving in the course of time—a long time it may be—at scientifically accurate conclusions on doubtful questions of Indian agriculture. The results of such experiments become misleading, and worse than useless, if the experiments are not made under the immediate supervision and control of skilled agency, and unless, before deducing conclusions from the reported results, all disturbing accidental elements of season and the like are carefully and intelligently observed and their effects eliminated. It is obvious that work of this kind cannot be done by ordinary officers of Government or agents of the Maharajah without special knowledge or training, and therefore, unless a special officer is made available for this purpose, or the Maharajah himself employs a Cirencester graduate at his own expense, I am unable to think that any permanently useful purpose will be served by carrying on agricultural experiments in Doomraon in the manner hitherto adopted. It may be supposed that there is no reason why the Maharajah should not work his home farm through his ordinary employés in accordance with the advice of officers of the Agricultural Department; but apart from the fact that, as I have frequently pointed out, there is very little in which the officers of the department are without further enquiry and experiment prepared to give dogmatic advice, it is further to be noted that mere advice on paper, without the agency and means for showing in actual practice the operation of the processes recommended, goes for little in most things, and for nothing in the introduction of novelties in Indian agriculture. This experimental station is, however, at present being worked under the immediate supervision of a subordinate Superintendent trained at Cawnpore, with such advice and assistance as can be given by Mr. A. C. Sen, who is stationed at Burdwan.

61. Local agricultural Shows were also held at Perozepore in Burrisaul, and Cox's Bazar in Chittagong, and at Mymensingh, under the direction of the local officers, but reports upon them have not yet been received.

Agricultural Implements.

62. *Ploughs.*—The question of supplying Bengal ryots with an efficient and cheap plough continues to receive attention. 486 Burrakar cast-iron ploughs, it is reported, have been sold during the year under review, but these ploughs

have not in general been very favourably reported upon. The cast-iron, it is said, soon wears away, and, moreover, has the drawback that, when once broken, it cannot, like wrought-iron, be repaired by native blacksmiths. The Shibpore wrought-iron inverting ploughs have been greatly improved, and those recently made work fairly well. It has not, however, been found possible to bring the price of this plough below Rs. 6, and its expensiveness is therefore a great impediment in the way of its general use by ryots. The fact that soil-inverting ploughs require strong bullocks to work them, and that they cannot be used at all in paddy cultivation, has led to attempts to improve the ordinary ryot's plough without converting it into a soil-inverting one. Colonel Neil, who has devoted much time and attention to the examination of agricultural implements, has invented a plough of this kind, which consists of a cast-iron share and a narrow mould board attached to a wooden upright. Mr. Sen has also invented a plough of this description, which looks very much the same as ordinary ryot's plough, but has a good wrought-iron share, while the form of the breast of the plough is somewhat altered. Private firms in Calcutta have been invited to undertake the manufacture and sale of such of these ploughs as, after trial, can be recommended by Agricultural Officers, and Messrs. Main and Company of Calcutta have undertaken to do so, and are arranging with their Glasgow correspondents for the importation of them at the lowest price that may be possible.

63. *Water-lifts.*—A simple and cheap, but efficient, machine for raising water is a great desideratum in India, where, on account of very rapid evaporation of water and irregular distribution of rainfall, artificial irrigation must be so often resorted to.

As mentioned in my last report, a cast-iron chain-pump, after the model of the Cawnpore pump, is being manufactured and sold at the Burrakar Iron Works. A fair demand has sprung up for this lift, which was exhibited and much appreciated at Doomraon, but it cannot be said that we have yet got the machine which we really want. The Burrakar water-lift works well when the height to which the water is to be raised is from 6 feet to 12 feet; above 10 or 12 feet the power required to work the pump is very great, while below 5 or 6 feet the common *donga* used by native agriculturists is a more efficient arrangement. Even for heights between 6 and 12 feet the Burrakar chain-pump is not free from defects, for, while it is being worked, the chain sometimes becomes attached to the grooved wheel in such a way that the work must be stopped in order to detach it. This pump, however, requires repair much less frequently than that known as the Cawnpore pump, and is cheaper and more efficient.

Co-operation of bodies interested in agriculture and trade.

64. I am much indebted to the Chamber of Commerce for the cordial co-operation and the ready aid they have rendered in appraising the value of different samples of wheat; in furnishing valuable information and suggestions regarding various economic products, and also in preparation of forecasts. The Agri-Horticultural Society also gave some assistance in procuring samples of economic products. As mentioned in last year's report, a programme of agricultural experiments to be tried by members of the society was drawn up in communication with the Secretary of the Society, and it was hoped that some of the experiments therein suggested would be tried by selected members of the Society; that the results would be reported; and that, where they proved to be successful, efforts would be made by such members to introduce in their neighbourhoods the improvements suggested by these results. No experiments of the kind seem, however, to have been tried, or, if tried, the results have not been reported.

65. *Forecasts of crops.*—Forecasts of the wheat and jute crops were prepared during the year, which the Dundee and Calcutta Chamber of Commerce have declared to be useful to them.

66. *Miscellaneous questions connected with Agriculture, Settlements, and the Tenancy Act.*—A considerable portion of my own time has been devoted to the preparation of reports and furnishing advice on various questions connected with agriculture, settlements and surveys, and the working of the Tenancy Act.

67. *Tours.*—During the year I visited Patna, Bhagulpore, Burdwan more than once in connection with agricultural work;

Mozufferpore, Chittagong, Noakhally, and Dinagepore, and Angul where settlements were being carried on under my supervision;

Berhampore, on enquiries relating to silk, and Serajgunge, on enquiries connected with preparation of jute forecasts.

I also visited Raipore and the Central Provinces with Sir E. Buck.

68. *Merits of Officers.*—All the officers employed in the Department continued to give satisfaction.

I have the honour to be,

SIR,

Your most obedient servant,

M. FINUCANE,

Director of the Agricultural Department, Bengal.

C E G.—Reg. No. 9244J.—400—14-9-87.

REVENUE DEPARTMENT.

AGRICULTURE.

CALCUTTA, THE 19TH DECEMBER 1887.

RESOLUTION.

READ—

The Director's report of the Department of Land Records and Agriculture for the year 1886-87.

The Director was employed during the year on surveying, with a view to settlement, the Government estates of Nulcheera and Angul, the Wards' estates of Sunkerpore and Churamon, and in making a survey and record of rights in a tract, the property of private persons, in the district of Mozufferpore, the whole area dealt with amounting to 1,845 square miles. The latter operations were of the nature of an experiment, conducted at the public expense, with a view to ascertaining how far it might be practicable and desirable to carry out similar work on a large scale, and at the cost of the locality benefited. Although the whole of the area originally selected was not measured, the object with which the task was undertaken seems to have been obtained, inasmuch as it has been shewn, so far as a conclusion can be drawn in a matter of this kind from a single instance, that the difficulties in the way of such operations are not insuperable. It was moreover found that in the great majority of villages much uncertainty existed as to the amount of the existing rent, so that positive good was done by ascertaining and making an authentic record of what was before indeterminate. No formal applications were made for the enhancement of rent, which was, however, in some instances, raised by private agreement between the parties. On the whole, the experience gained is favourable to the prosecution of the work of survey and record, but it appears desirable, in view of the Secretary of State's decision conveyed in the Government of India's letter No. 603R—27-11, dated the 3rd September 1886, to confine this, for the present at least, to estates the property of Government, or on which those interested appreciate and offer to pay for the advantages of a settlement. Even within these limits it is anticipated that employment will be found during the next cold season for the whole of the trained agency which Government can command. The conduct of these settlements now constitutes the principal duty of the Director of the Department of Land Records and Agriculture, an appointment which has recently been made permanent with the sanction of the Secretary of State.

Survey and Settlement.

2. Enquiries were made during the year by Mr. A. C. Sen and Mr. Sakhawat Hossein as to the agricultural practices of the districts of Dacca and Mymensingh. These investigations should be made, and their statistical results recorded in such a manner as to be of use in connection with the revision now being made of the Gazetteer of Bengal. Mr. Sen has made a very high estimate of the agricultural capabilities of the large tract of land which forms and surrounds the Madhupore jungle, and considers it particularly suitable for the cultivation of sugarcane, cotton, rhea, and mulberry; but for want of capital and enterprise its resources remain at present undeveloped.

Analysis of districts.

3. Much anxiety has been felt by those interested in the silk industry in Bengal on account of the spread of diseases among worms, particularly of what is known to the rearers as *kata*, and is pronounced by Mr. Wood-Mason to be the same as the *pebrine*, which has in recent times broken out in an epidemic form in Europe. A French expert, Monsieur Clement, has recently been engaged for two years to investigate and deal with the subject upon the system introduced by Monsieur Pasteur. In the meanwhile, Mr. N. G. Mookerjee, a Cirencester scholar, has been engaged on the work; his labours are, as the Lieutenant-Governor ascertained when on tour, much appreciated by those best able to form a judgment, and seem to have met with some actual success. The Director states that—

Eradication of disease among silkworms.

"The native rearers have shown a preference for the seed reared and microscopically examined by Mr. Mookerjee to that reared in the ordinary way, and went so far as to incur

the expense of buying, according to his advice, untainted mulberry leaf at a high price, rejecting leaf in their possession, which is believed to be tainted, by use on the land, on which it was grown, of manure containing excreta of diseased silkworms. Mr. Mookerjee now thinks that he has eradicated disease from his experimental Madrasi stock, and he is probably right; but it remains to be decided by the expert from Europe, who is soon expected, whether he has really done so. If it should prove that he has, then the question of the extension of the methods adopted by him will have to be carefully considered Enquiries are also being made on the subject of the natural history and ravages of the silkworm fly, of which little is at present known."

Agricultural experiments.

4. The cost to Government of the agricultural enquiries and experiments conducted during the year, including the distribution of implements and seeds, was Rs. 6,860. Some work of this nature was also done by private individuals, particularly by the Maharajah of Doomraon, at their own expense, but with the assistance of the Department. The results obtained were, in many instances, valuable rather for future comparison than for immediate application. It is stated that Mr. Sen sold during the year under report more than a hundred maunds of bone-meal to ryots of the villages in which he had distributed small quantities *gratis* during the previous year, and that the purchasers are keenly watching the effects of the manure. The introduction of the superior Buxar wheat into Bhagulpore was not so successful this year as last, but nevertheless it appears to be in that Division an improvement likely to have permanent results. Beyond Bhagulpore the seed has not hitherto done well. It is stated that 486 of the improved Burrakar ploughs were sold during the year, but that they have not in general been very favourably received, as they require strong bullocks to work them, and cannot be used for paddy cultivation. Further efforts are being made to supply a plough adapted to the peculiar conditions of agriculture in this country. As to improving the breed of cattle Mr. Finucane remarks:—

"Two Hissar bulls were supplied for use on the Government estates in Arrah and Sasseram, and two half-bred English bulls were presented to Government by Dr. Greenhill. Of these, one, out of a fine country cow by Zooloo, an imported Jersey bull, has been made over to the Manager of the Burdwan Raj, and the other, out of a fine Hansy cow by an imported Durham bull, was given to the Arrah Municipality, that body having undertaken to provide for the maintenance and custody of the animal, and to report through their Chairman whether any improvement in the local breed of cattle may be effected by means of it. These are but isolated and insignificant efforts, but to anybody who is acquainted with the improvement effected by Mr. Tayler, when Commissioner of Patna, in the breed of cattle in that locality by the introduction of one or two English bulls—an improvement which is visibly marked up to this day—it will be apparent that even isolated efforts of this kind may effect some good, and if other municipalities and public bodies would follow the example set by the Arrah Municipality, and would interest themselves in seizing and weeding out such of those wretched country bulls as are diseased, and now roam about spreading disease wherever they go, and if they would keep for public use, in local pounds or elsewhere, a suitable and superior class of sires, which might be procured for them at their expense by Government, much might be effected towards improving the breed of cattle in these Provinces, without entailing any expenditure on the State."

This is a subject to which the attention of Agricultural officers is invited with a view to further suggestions, for the guidance of zemindars and others who take an interest in improving the breed of cattle. It is understood that sires are now generally provided by individuals who do not seek any profit for themselves, but to benefit the public, and to observe a custom to some extent connected with religion. Persons acting from such motives would probably be in many instances amenable to well-considered advice. The Director expresses himself much indebted to the Chamber of Commerce for the cordial co-operation and the ready aid they have rendered in appraising the value of different samples of wheat; in furnishing valuable information and suggestions regarding various economic products, and also in preparation of forecasts. The Agri-Horticultural Society also gave some assistance in procuring samples of economic products.

5. The thanks of the Lieutenant-Governor are given to Mr. Finucane for his efficient performance of his duties during the year. He states that all the officers employed in the Department continued to give satisfaction.

By order of the Lieutenant-Governor of Bengal,

P. NOLAN,
Secretary to the Govt. of Bengal.

No. 3898—676Agri.

COPY with copy of the Report, forwarded to the Secretary to the Board of Revenue, Land Revenue Department, for the information of the Board.

No. 3899—677Agri.

COPY forwarded to the Director of the Department of Land Records and Agriculture for information.

Circular No. 37Agri.

COPY, with copy of the Report, forwarded to all Commissioners of Divisions and District Officers (through Commissioners) in Bengal for information

By order of the Lieutenant-Governor of Bengal,

W. C. MACPHERSON,

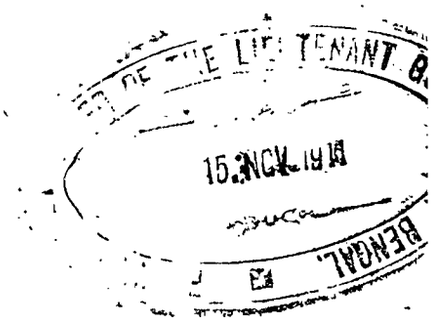
Under-Secretary to the Govt. of Bengal.

CALCUTTA,
The 28th December 1887.

C. E. G.—Reg. No. 13166C—6-4—3-1-88.

REPORT

OF THE



AGRICULTURAL DEPARTMENT, BENGAL,

FOR THE

Year ending 30th June 1911.

CALCUTTA:

BENGAL SECRETARIAT BOOK DEPOT.

1911.

Published at the BENGAL SECRETARIAT BOOK DEPÓT,
Writers' Buildings, Calcutta.

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DEPARTMENT OF AGRICULTURE, BENGAL.

No. 10034A.

FROM W. B. HEYCOCK, Esq., I.C.S.,
Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

Dated Calcutta, the 14th September 1911.

SIR,

I HAVE the honour to submit the sixth Annual Report of the Agricultural Department, Bengal, for the year ending 30th June 1911. The form and headings of the present report have been changed in accordance with the instructions contained in the Government of India's letter No. 9—91-2, dated 25th April 1911, copy of which was forwarded to this office with your Memorandum No. 382T-R., dated the 9th May 1911.

I have the honour to be,
SIR,
Your most obedient servant,

W. B. HEYCOCK,
Director of Agriculture, Bengal.

[Annual Limit 15 pages]

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REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL.

(For the year ending 30th June 1911.)

CHAPTER I.

ADMINISTRATION.

Charge.—Under Government Resolution No. 2519T. R., dated the 6th October 1904, all correspondence relating to "Agriculture" used to pass through the Board of Revenue in the Land Revenue Department. But for administrative reasons the Agricultural Department, with all its subordinate offices, has been brought directly under the Government of Bengal, in the Revenue Department, since March 1911. Mr. W. H Buchan was in charge of the department until the 7th of October 1910, when Mr. W. R. Gourlay rejoined on relinquishing charge of his appointment as offciating Secretary to the Government of Bengal in the Revenue and General Departments. I took over charge of the department on the 10th April 1911, when Mr. Gourlay went on leave. During the latter part of the year under report there were several changes among the officers of the department. Mr. Smith, Deputy Director, went on six months' combined leave with effect from the 1st April 1911, and Mr. Dobbs, Principal of the Bengal Agricultural College, acted for him, in addition to his own duties. In the meantime, the services of Mr. Dobbs were transferred to the Imperial Department of Agriculture and Mr. E. J. Woodhouse, Economic Botanist to the Government of Bengal, was appointed Principal of the College in addition to his own duties. Mr. G. Sherrard, a supernumerary officer in the Imperial Agricultural Service, was appointed Professor of Agriculture in place of Mr. Dobbs and was gazetted to act as Deputy Director also during Mr. Smith's absence on leave. Babu Nagendra Nath Sircar, Deputy Magistrate and Deputy Collector, worked as Personal Assistant to the Director of Agriculture throughout the year.

2. *Staff.*—The Secretary of State's order sanctioning the scheme for the reorganisation of the departmental staff was received after the close of the year under report. Effect is now being given to it. The college staff, as originally contemplated, is now complete. A new Divisional Agricultural Association ws formed for the Tirhut Division and an Agricultural Inspector was appointed for it towards the latter end of the year. The post of the Agricultural Inspector in the Presidency Division remained vacant for some time during the year, as the Inspector, Babu Debendra Nath Mukerjee, left his post without notice. His services were dispensed with for this and other reasons. Babu Bhabotosh Dutt, a passed student of the Sibpur Agricultural College, who previously had worked in this department for a long time as Farm Superintendent and as Travelling Inspector, has recently been appointed Agricultural Inspector in the Presidency Division. There was no other change in the field staff of the department. The post of the Superintendent of well-boring remained vacant during the year for want of a suitable man.

Four students who were sent for training in agriculture to the Agricultural Colleges at Poona, Cawnpore and Nagpur, passed out successfully in April last. Two of these students have been given post-graduate scholarships for further training at the Pusa Research Institute and Agricultural College. One of them has been appointed temporarily to act as second Travelling Inspector of this department—a post which has been vacant for a long time for want of a suitable candidate. The remaining student has not yet been offered any appointment.

3. *College.*—The Agricultural College at Sabour was opened on the 3rd November 1910. It is now fully equipped with furniture and fittings. A gas and water plant were erected during the year. Arrangements are also being made for building quarters for two more assistant professors and for building a dispensary with quarters for a hospital assistant. The laying out of the college grounds has not been completed yet.

4. *Agricultural Stations.*—Fair progress was made with the work of laying out the Sabour and Chinsurah stations during the year. The area added to the Cuttack Agricultural Station last year was properly laid out, and such roads, water-channels and culverts as were necessary, were constructed. The whole area of the Bankipur Agricultural Station is now being brought under cultivation. The Chaibassa Tassar Farm has been closed, as it has not proved a success, and there was no prospect of useful work being done there. A demonstration farm has been started at Sambalpr on land offered by Babu Ram Krishna Behara, a member of the Destrict Agricultural Association. This farm, which consists of 50 acres, is situated at a distance of 1½ miles from Sambalpur. The owner of the land is responsible for the up-keep of the farm and takes the crops, but Government assists by contributing Rs. 40 per mensem to meet the pay of the Overseer. The District Agricultural Association of Birbhum is making arrangements to start a demonstration farm at Suri, on condition that this department indemnifies the farm against any loss exceeding Rs. 250 up to a limit of Rs. 500 per annum for three years. The establishment of an agricultural farm in the Bettiah Estate, at the cost of the Bettiah Raj, has been sanctioned lately, and steps are being taken to open the farm as early as possible.

5. *Sericulture.*—Babu Apurva Coomar Ghose, Superintendent of Sericulture, was in charge of the sericultural work. The steps hitherto taken for the improvement of the silk industry in this Province having failed to arrest the decline of the silk industry, it has been decided, on the recommendation of Mr. Lefroy, the Imperial Entomologist, and the Inspector-General of Agriculture, in addition to other measures to try a system of hybridising under the supervision of an expert officer from Europe for a period of five years. Arrangements are now being made to secure the services of a suitable man from France, through Messrs. Anderson Wright and Company, and to start the experiment as soon as the expert arrives.

6. *Fisheries.*—For the further development of the fisheries of Bengal, the Secretary of State, in his despatch No. 19R., dated the 24th February 1911, has sanctioned the appointment of a Deputy Director of Fisheries for two years and the creation of two permanent posts of Superintendents of Fisheries. A fishery expert having the requisite special qualifications for the former post has been appointed by the Secretary of State, and he is expected to join his appointment by the middle of December next. Mr. B. Das has been confirmed in one of the posts of Superintendent of Fisheries, and Mr. Mohsin holds the other appointment on probation.

7. *Tours.*—Mr. Buchan was on tour for 46 days and Mr. Gourlay for 58 days. I spent 11 days on tour in April and was at Darjeeling in May and June. As usual, the Deputy Director inspected all the agricultural stations very frequently. Messrs. Dobbs, Taylor, Woodhouse and Sherrard also made occasional tours during the year.

8. *Miscellaneous* —The first regular wage census was taken in April 1911, and the returns of wages received from the official and non-official correspondents are now being scrutinised and compiled in the Director's office. The report will be published as soon as possible.

9. The crop forecasts, agricultural statistics, reports and statistics on weather and crops, prices and rainfall, were prepared and published as usual.

10. *The Quarterly Journal of Agriculture* continued to be published during the year and the number of subscribers rose to 286 against 275 in the previous year.

11. There was no meeting of the Board of Agriculture during the year. It has been decided to hold meetings of the Board every alternate year instead of every year, in future. The next meeting of the Board will be held in November next.

CHAPTER II.

Agricultural Education.

12. The Agricultural College at Sabour was opened on the 3rd November 1910 and was inspected by His Honour the Lieutenant-Governor on the 7th November. The number of students admitted during the first year was 21. All are Hindus and six came from Eastern Bengal. The first session ended on the 31st March 1911. It will not count towards the diploma course, which will continue for three years from June 1911. It has, however, served the purpose of enabling the staff to form an idea of the standard which it will be practicable to aim at under present conditions. The decision not to count the first session as part of the three years' course has had the further advantage of bringing the academic year into conformity with the agricultural year. The staff of the College as originally contemplated is now complete, as an Assistant Professor of Chemistry and Physics and Demonstrator have joined during the year. Arrangements have still to be made for the teaching of Veterinary science.

13. His Honour made a special grant of Rs. 4,000 for the College library and Rs 1,000 for the students' library and athletic club.

14. The agricultural classes attached to the Cuttack, Hazaribagh and Burdwan schools have now been closed. It was found that they were of no practical value. The agricultural classes attached to the Gaya Zilla School and Dumraon High English School are to be kept up for a further period of three years, as the classes attached to these two schools have shown some results, and it was felt that the boys who have already started the course should have an opportunity of finishing it. In connection with these classes, the whole question of Agricultural Education was considered at a conference held between officers of this Department and the Education Department in April last. It was pointed out that agricultural classes attached to schools are of no value as a preparation for the Agricultural College at Sabour, and are not calculated to turn out boys fit for employment in the Agricultural service without further training. It was explained that it was not the intention of the Agricultural Department to press for the establishment of agricultural classes, as likely to be of use to the department or in any way to take the place of Sabour. Anyone wishing to obtain an agricultural education, ought to come to the college at Sabour, and no special preparation is required for passing the necessary qualifying tests for admission to the College. It was therefore agreed that the agricultural classes should be discontinued, and that an effort should be made to prescribe a simple course of nature study for all schools under the supervision and direction of the Education Department, leaving it to boys who wish to study agriculture to go to the College at Sabour in due course. With a view to encourage nature study and the study of plant life in guru-training schools, middle schools and primary schools, the Director has approved generally of a suggestion made by the Inspector of Schools, Orissa Division, to award prizes to the gurus and students from the funds of the Agricultural Department. The experiment is to be tried first in the Orissa Division, and if successful will be gradually extended to the other divisions. The settlement of details is still under discussion with the Education Department.

15. The practice of training sons of cultivators at the experimental stations was continued during the year. At Cuttack an overseer and four student cultivators received practical training during the year. There is a student under training also at Bankipore. The District Agricultural Associations as a whole appear to be slow in taking advantage of this privilege. Still, the District Agricultural Associations of Nadia and Saran have made enquiries and intimated their wish to send student cultivators for training at the experimental stations. I hope in time other District associations will send men for training. These student cultivators receive free quarters at the farms and are paid as farm labourers at the ordinary local rate. On their return to their homes they must be in a position to improve the cultivation in their neighbourhood by showing the result of their training in their own fields.

CHAPTER III.

Research and Experiments.

1.—*Agriculture.*

16. *Agricultural Stations.*—There are six agricultural stations, viz. Chinsura, Burdwan, Bankipur, Dumraon, Sabour and Cuttack. There is also a demonstration farm attached to the St. Andrew's Colonial Homes at Kalimpong. A brief account of the work done at each agricultural station is given in Appendix I. A full report on each station, containing the scientific record of the year, will be published separately.

17. *Sugarcane.*—The members of the Bihar Planters' Association have undertaken the cultivation of sugarcane on an extensive scale. The season was a better one than the last two and good outturn was received in every case. A hand-power centrifugal sugar machine was presented to this department by the Inspector-General of Agriculture, with instructions to see if cheap white sugar can be produced locally. The experiment will be taken up by the Agricultural Chemist at the Cuttack and Burdwan Agricultural stations during the next cold weather.

18. *Indigo.*—Mr. C. J. Bergtheil was in charge of the Indigo research station at Sirsiah. He was absent on leave from the 29th of August, 1910 to the 4th March 1911, and Mr. F. R. Parnell, the Botanist, was in charge during his absence. Mr. Bhailall, Assistant Chemist from Pusa, joined the staff on June 1st 1911. The Advisory Committee, which consists of four practical planters, the General Secretary to the Bihar Planters' Association, and Mr. Bergtheil, held 13 meetings during the year,—2 at Sirsiah and 11 at Muzaffarpur, the average attendance being 62 per cent. The total expenditure for the year was Rs. 41,833-2-7, of which Rs. 32,500 were contributed by Government. Several reports and notes were published by the Committee during the year.

The station was badly flooded from 29th of July to 5th August 1910. No damage was done to the buildings, but a very serious loss of selected plants, &c., occurred as the result of the unprecedented flood.

19. Although all the experiments in the pot culture house were spoilt by the flood and no definite conclusion on any of the points which were under investigation could be drawn, a certain amount of useful experience as to the method of treatment of the indigo plant in pot culture was obtained and the year's work was therefore not absolutely wasted. Some useful knowledge was gained on such details as the size of pot to use, the amount of moisture necessary in the soil and so on, and advantage has been taken of the knowledge so obtained in starting a new set of cultures this year.

20. A good deal of work on the physiology of indican production and its disposal has been done during the year, but the results so far obtained are too incomplete and of too purely scientific a nature to record. The collection of indigo-yielding plants has progressed well, and there are now a fairly large number of indigo-yielding *indigo ferœ* and other species of plants obtained from all over the world.

21. A detailed report on Mr. Bergtheil's work under the Sirsiah Committee has been separately published, and a copy of it will be submitted to Government in due course.

22. *Jute.*—Only 27 acres of jute were cultivated by the members of the Bihar Planters' Association, and this was practically for their own requirements. The prices ruling in Calcutta were not anything like high enough to pay the Bihar planters to grow this crop.

23. *Flax.*—Under his agreement with the Bihar Planters' Association, Mr. E. Vendekerkhove, the Belgian flax expert arrived at Dooriah Factory, Muzaffarpur, on 20th October 1910, and left for Europe on 29th March 1911. The cost of his services and passage out and home amounted to Rs. 5,500, and this amount was met from the joint grant made by the Inspector-General of Agriculture in India and this Department. Mr. Vendekerkhove's report on

the results of his work is being separately published by the Association, and a copy of it when received will be submitted to Government.

24. *Crop-cutting experiments.*—Returns showing results of crop cutting experiments made during the year have been received and compiled in this office. The number of experiments made amounts to 850 as against 887 in the preceding year. These results will be incorporated in the quinquennial report which is due to Government in July 1912.

2.—CHEMISTRY.

25. The time of Mr. C. S. Taylor, the Agricultural Chemist, was occupied in teaching chemistry and physics and in carrying on lines of scientific work in the research laboratory in connection with different agricultural problems of this Province. The laboratory at Sabour was finally ready for use in October last. The work on sugarcane has been continued this year and a large amount of work on soy beans has been done in co-operation with the Economic Botanist on single plant-selections. This work has given very interesting results in connection with the varieties indigenous to Bengal. A separate report on classification and examination of canes at present indigenous to Bengal was published during the year as Departmental Record No. 3 of 1910. Some investigations have also been undertaken on the soils of the different experimental plots of the Cuttack Agricultural Station, and 1,691 samples of soils, manures and food-stuffs, etc., were chemically analysed. A quantity of *data* in connection with the oil-pressing industry has also been collected. In addition to what might be strictly called laboratory work, some experiments have also been carried out with Broadbent's sugar turbine, to see how far the manufacture of country sugar by its means is likely to pay in the neighbourhood.

3.—BOTANY.

26. The scientific botanical work has been much facilitated by the completion of the Garden Laboratory in July 1910. During the year the plant-breeding work has been continued successfully. Of the leguminous crops under investigation, work has been continued upon the *bhadoi* pulses of the Province, and special attention has been paid to the cultivated forms of the genus phaseolus, in which genus a large number of varieties have been isolated. A large number of the single plant cultures are now in their second year of cultivation. The indigenous varieties of soy beans *glycine hispida*) have also been under investigation, and a large amount of chemical work has been done on them by the Agricultural Chemist in co-operation with the botanical department. The bulk of the cultures are now on their second year. Work is also being done on *kulthi* (*Dolichos biflorus*), *seem* (*D. Lab. Lab.*), sun hemp (*Crotolaria juncea*) and some species of *stizolobium*. Of the *rabi* pulses some varieties of peas *pisum spp.*) were tested and some cultures of *masur* (*Ervum lens*) were examined. Of the graminaceous crops, sugarcane is still under examination, and a series of 88 pure cultures were planted in March. Of the millets, *kaoni* (*setaria italica*) and *marua* (*Eleusin coracana*) are still under examination and the majority of the single plant cultures are in their second year.

27. The specimens of 276 species which had not been previously collected have been added to the Herbarium, and a number of teaching specimens have also been collected. The chief work in progress is a Student's Flora of the Sabour Farm, which is intended to include information concerning the life histories and habitats of the various species. This flora was commenced from January last, and the observations will have to be continued for at least one year. An account of the differences in the flora of a field caused by green manuring was published in the *Quarterly Journal*, Volume IV, No. 1.

28. The opening of the college teaching in November 1910 has of necessity decreased the amount of scientific work done in the Botanical section. A number of specimens for teaching have been collected, and a card index has been prepared of the diagrams of models and slides in order to facilitate the preparations for lectures and demonstrations.

29. The main work of planting up the area of the Botanic Garden has been completed in the year under review.

4.—ENTOMOLOGY.

30. During the year under report the Entomological section had to deal with numerous insect-pests of field crops, fruits, etc. Some of the principal are given below.

31. *Jute.—Diacrisia obliqua, Wlk.* (Bihar hairy caterpillar) was reported from Chinsura, attacking jute and *dhaincha* very severely. The Assistant Entomologist completely checked the attack by trenching and spraying with Lead chromate, and arseniate and so saved a considerable area of the jute and *dhaincha* on the Chinsurah Farm. It also attacked cotton and pulses on the Sabour Farm, but was easily checked by picking. It was also reported from Begpur, Bhagalpur.

32. *Sugarcane.—Scirpophaga auriflua, Zell.* (White-borer) attacked sugarcane shoots in the Sabour Farm. It was completely checked by picking.

Ripersia sacchari, Gr. (Rice mealy bug) attacked the sugarcane crop in Sabour Farm. They were between the leaf sheath and the stalk near the surface of the ground. As an experiment, the attacked plants were earthed up, and this was found very successful as all the bugs were dead after a week.

33. *Agrotis ypsilon.*—A full account of the work done on this pest has appeared in the *Bengal Quarterly Journal*, Volume IV, No. 4, "Surface caterpillars at Mokameh," by E. J. Woodhouse and H. L. Dutt, which is summarized below. It was found that small attacks occurred in small isolated areas in September, which were followed by the main attack, doing serious damage over 6,000 acres a month later. A casual attack of prodenia over a small area also occurred during the season, which complicated the problem. It would seem that the future policy should be to attempt to destroy the small first broods appearing in September which probably give rise to the destructive brood appearing a month later. Arrangements are being made to carry out this policy. The pest has also been reported from Colgong and Pakur on *chaur* land similar to that at Mokameh.

34. *Prodenia litura, F.* (Tobacco caterpillar).—This pest destroyed the crop on 100 acres of the Mokameh *tal*, and was checked by hand-picking.

35. *Phthorimœa operculeila, Zell.*—(Potato moth) did a considerable amount of damage to stored potatoes at Patna. A full account of the work on this pest has appeared in the *Bengal Quarterly Journal*, Volume IV, No. 4, "Potato Moth at Patna."

36. *Betel leaf.*—During the scare about betel leaf poisoning at Calcutta and some other places, the Assistant Entomologist was sent to investigate the matter. The crops in several places were examined and the leaves were found to have no insect in them.

37. *Mango.—Batocera rubus, Linn.*—(Mango-borer) was reported from Bhagalpur. The Assistant Entomologist inspected the damage and the holes of the borers were plugged with cotton soaked in carbon bisulphide. The trunk was then plastered up with mud.

38. *Minor pests.*—Among minor pests red ants (*Monomorium destructor, Jerd*) were reported as infesting the S.S. *Lanka*, and Tenebrionid beetles as infesting the Subdivisional Officer's house at Pakur; information concerning methods of checking the attack of white ants (*Termes obesus*) on rose trees and Gulmohurs were asked for from Bhagalpur and Monghyr, and Lilly caterpillar (*Palytela gloriosæ, Fabr.*) was reported from Muzaffarpur and *terias hecabe* as attacking *dhaincha* in Cuttack. The Monghyr District Board complained of damage to avenue trees by lac.

Economic Insects.

39. *Lac.*—Assistance has been given to Mr. J. B. Robinson of Sagrampur in inoculating lac on the jungles of South Monghyr.

40. *Eri silk.*—Efforts have been made to persuade the silk merchants at Bhagalpur to take up agency work for *eri* silk cocoons. A grant has been obtained for the rearing work from April 1st, 1911, a rearing-house has been built and the rearing work commenced.

41. This department is in close touch with the Entomological work at Pusa and besides the great assistance received from the Imperial Entomologist in the campaign against the caterpillar pests at Mokameh it freely received his help in identification of specimens, in treatment of crop pests and in making a start with the cultivation of *eri* silk, which was taken up at Sabour from 1st April 1911.

5.—MYCOLOGY.

42. During the year under report several crop diseases were investigated. A few of the principal are mentioned below :—

(1) *Paddy.*—Diseases of paddy were reported from eight different districts, namely, Manbhum (Dhanbaid); Muzaffarpur (Hajipur) Nadia (Chuadanga); Durbhanga (Benipur), Angul, Gaya (Nowadah and Chouk), Sambalpur and Bhagalpur. They have been reported under different local names, such as *Dakhina, Chatra, Dakhinabiva, Bhangiputti, Kharka*, etc., and perhaps represent more than one form of disease. Their cause or causes are still obscure, although occasionally a fungus has been found associated with them. It is not improbable that water-logging and imperfect æration of the soil are mostly responsible for the diseased condition of the plants which seem to recover under the application of Hyde salt ($Na_2 So_4$) sodium sulphate (*khari nimak*) at the rate of 15 to 20 seers per acre while the water is still standing in the field. Sometimes, it is said that simply draining the fields, allowing them to dry and reflooding them has been found successful. Local investigations were carried out only at one place, namely, Hajipur, which led to the conclusion that the disease there had been induced by water-logging.

(2) *Sugarcane.*—The two most common diseases of sugarcane were investigated on the Sabour Farm and at Sambalpur, Cuttack, Chinsurah and Burdwan. The first "red rot" caused by *Colletotrichum falcatum, Went.*, was found to be of general occurrence wherever this crop is cultivated, causing great damage, from which the only safety lies in the selection of sets. The smut disease of sugarcane caused by *ustilago sacchari, Rab.*, was investigated at the local farm where it has been found to cause certain amount of damage only to the *khari* cane; other varieties of canes have not been found to be seriously injured by it. The removal and burning of diseased clumps is being carried out in order to check the disease.

(3) *Potato.*—The diseases of potato were reported mostly from Bankipur, where local investigations were made by Mr. Bhattacharyya. Specimens were also sent to the laboratory for examination both from Bankipur and from the local farm. Three distinct diseases were noticed, namely, a bacterial disease caused by *Bacillus solanacearum, Smith*, a root disease caused by *Rhizoctonia solani, Kuhn*, and a leafspot disease caused by *Macrosporium solani, E.* and *M.* The last was reported from the local farm.

43. The Agricultural Department is much indebted to the Imperial Entomologist and Mycologist and the other officers of the Agricultural Research Institute, Pusa, who have always readily given any assistance asked for.

6.—SERICULTURE.

44. The general control and management of the sericultural work continued to be vested in the Silk Committee with the Director as President and the Collector of Murshidabad and four representatives of the principal silk firms in Bengal as members. Babu A. C. Ghose remained in charge of the sericultural operations throughout the year with a staff of two Assistant Superintendents, Inspectors and Overseers to help him. During the year the Committee held five meetings, four of which were presided over by the Director of Agriculture and one by the Collector of Murshidabad.

Almost all the meetings were attended by visitors who appear to take great interest in the proceedings of the Committee. The special meeting of the Silk Committee held on the 2nd April 1911, which was attended by a large number of rearers and small filature owners, was very important, because it was settled at that meeting to change the policy hitherto pursued. In 1906 it was decided to make a sustained experiment to produce an improved seed of each of the three chief breeds of worms in Bengal, viz., *Chotapalu*, *Nistari*, *Barapalu*, in the hope of producing silk equal in quality to China, Japan or Italian silk. The efforts hitherto made in this direction have not arrested the decline of the silk industry. Mr. Lefroy, the Imperial Entomologist, has also recorded it as his opinion that it is useless to expect to improve the present races of *Nistari* and *Chotapalu* and to get from them silk of quality equal to China, Japan or Italian; that by no selection or other process will these even give an inherently better silk, the quality of the silk being a character of the race and so unalterable. Having regard to the fact that the improvement of the quality of the silk is one of the best means of improving the silk industry, it was decided to follow Mr. Lefroy's advice and give a trial to a system of hybridising recommended by Mr. Lefroy, the Imperial Entomologist, and approved by the Inspector-General of Agriculture in India. According to this system it is proposed to rear a brood of European univoltine worms from imported seed in February or March, to cross these with the best Indian multivoltine worms and to rear the hybrids till October and then to rear another brood of univoltine and continue the process. To give this experiment a fair chance of success it was felt that the services of a first rate expert should be engaged, who had had a special training in the principles of mendelism and skilled hybridising. These proposals have been sanctioned by Government, and Messrs. Anderson, Wright & Co. to whom the negotiations have been entrusted are arranging for a French expert through their head office at Lyons. The experiment will be tried for three years, Messrs. Anderson, Wright & Co. contributing Rs. 2,400 towards the cost and the Silk Committee the balance. If the experiment is successful, it will be carried on for a further period of two years and the Silk Committee will bear the entire cost.

45. It has also been decided to give up the system of building small outlying nurseries and to concentrate operations in central nurseries where there is better and closer supervision. Accordingly the nurseries at Saktipur in Murshidabad and Ghatal in Midnapore will be converted into central nurseries and the central nursery at Kalitha will be extended. The number of central nurseries will be increased as occasion demands. To supervise these central nurseries the staff will have to be increased, but it is hoped that the extra cost thereby incurred will be met from the income of the nurseries. The main object of the nurseries is to provide pure seed, and it is felt that this object can be better obtained by a system of central nurseries with effective supervision.

46. It is useless to provide rearers with pure seed, if the surroundings of the village rearing-houses are diseased. To meet this difficulty a scheme for disinfection of village rearing-houses has been formulated and a staff is being trained to carry out this duty. Progress must of necessity be slow, because it is useless to send out supervisors to superintend disinfection unless the supervisors are themselves thoroughly trained. Supervisors will be trained in the central nurseries and sent out on disinfection duty as soon as their training is complete.

47. Steps are being taken towards the establishment of central nurseries and the provision of a supervising staff to disinfect village rearing-houses. It is hoped that substantial progress will have been made in both directions by the end of 1912-13.

48. At present there are 19 nurseries or rearing-houses in all. The Berhampore Central Nursery with seven rearing-houses and a mulberry plantation of 60 bighas is now complete, and almost all the rearing-houses are in full working order. Seeds were reared in almost all of them very successfully throughout the year. The total sale proceeds received from the outturn of the nurseries during the year under report amounted to Rs. 7,858 as compared with Rs. 6,566 of last year and Rs. 5,874 of the preceding year.

49. There was no outbreak of disease among the worms reared from microscopically examined seed in the Committee's nurseries, and requisitions for seed, which were met as far as possible, were received from various parts of the country and from Manipur, Eastern Bengal and Assam, Pusa, Hyderabad, Gwalior and from Morocco in Africa.

50. The first final examination of the six boys who were undergoing training on a stipend of Rs. 8 each per mensem at the sericultural class in the Berhampore Central Nursery was held, and the successful students will be helped to start nurseries of their own on approved lines under the supervision of the Superintendent under certain conditions laid down by Government.

51. Some of the rearers, who were supplied with Bulu or White cocoons originally imported from China, raised successful crops from them and succeeded in selling off their outturn. The growing of Italian mulberry was continued with great success, and cuttings were distributed free of cost. The feeding of the worm with Italian mulberry at the last stage has been found to be a preventive for grasserie. The experiments in cold storage for the production of healthy worms by placing the seed cocoons in the cold storage of the Linde British Refrigerating Co., Ld., were continued with great success. The process has been found very useful in supplying the different breed of seed according to the demand of the different seasons.

52. During the year various sorts of sericultural exhibits were sent to the United Provinces Agricultural and Industrial Exhibition and to some of the district exhibitions in this province, and in some places demonstrations of the methods of rearing, detecting diseases, etc., etc., were made. Professors and experts from Japan, Burma, Pusa and the United Provinces paid visits to the central nursery at Berhampore to see the working of the system of rearing silk worms and mulberry growing, and training of rearers' sons during the year.

53. The fate of the Sabang Sericultural School has been finally decided. The School Committee having failed to secure the necessary lands and a tank for running a nursery, the Bengal Silk Committee, after replanting the mulberry land which had been uprooted by them, gave up the management to the School Committee, whose connection with this department has now ceased.

7.—FISHERIES.

54. The work of the Fishery Department during the year under report was largely confined to—

(1) Experiment in the breeding of carp in confined water.
(2) Investigation into the spawning ground of *hilsa*.
(3) Experiment in *bheri* culture.
(4) Fishery survey of the Monghyr district.

55. *Carp culture.*—The object of this experiment is to find out whether the Bengal carp, viz., *rohu*, *katla*, *mrigal* and *kalbasu*, breed in confinement. At Bhagalpur seven tanks (five breeding and two stocking tanks) were prepared. Three of the breeding tanks, which depended on local rainfall, could not be utilized for want of sufficient rain. Of the other two breeding tanks, only one could be properly supplied with water. In these two tanks experiments were made with *mrigals* and *katlas*. In one tank 20 male and 11 female *mrigals*, and in the other 10 male and six female *katlas* were placed. No conclusions could be drawn from the experiment made with the *katlas* as they had to be removed before maturity owing to the water in the tank drying up. The result of the experiment with the *mrigals* was negative. They were removed in October, and on dissection were found to be spent. No fry, however, could be found in the tank. Similarly, the experiments with *rohu*, conducted at Berhampore in two tanks in the Sericultural garden and in a tank kindly placed at the disposal of the department by Babu Sriban Vehari Sen, led to no results, possibly owing to the presence of predacious fish which could not be removed entirely from the tanks where the experiments were held. This year Berhampore has been selected for the experiments, which will be carried on over a period of three successive years. Arrangements have been made to secure a good supply of water for the tanks and to remove all predacious fish by completely emptying the tanks before the experiments are started.

56. *Hilsa culture.*—Mr. S. M. Mohsin carried on his investigation into the spawning grounds of the *hilsa* in the Ganges and its offshoots up to November 1910. He visited from time to time almost all the important *hilsa*-fishing localities in the districts of Shahabad, Patna, Monghyr, Bhagalpur, Sonthal. Parganas, Hooghly, Nadia, Jessore, Khulna and Murshidabad with a view to examine the reproductive organs of the species in their various stages of growth and also to ascertain their spawning grounds and spawning time. Goalundo, where the largest number of *hilsa* are caught every year, was also visited several times during the season. As the result of his last year's enquiries, Mr. Mohsin came to the following conclusions :—

(1) That the spawning time of the *hilsa* is September and October.
(2) That the spawning grounds of the fish are situated in the higher reaches of the Ganges.

At the end of September last Mr. Mohsin observed a large number of fully mature *hilsa* of both sexes at Monghyr and Buxar, which led him to believe that these two places are the spawning grounds of the fish. There is no further positive evidence to justify the above conclusion, still Mr. Mohsin has been permitted to make *hilsa* hatching experiments during the current year for a week or two at Monghyr when ripe fish are available at the place. He has also been directed to make further investigations with a view to verify his last year's results and to collect additional data in support of his conclusions; and in addition to this he has been directed to ascertain where the other spawning grounds of the *hilsa* in the Ganges and its tributaries are located.

57. *Bheri culture.*—A portion of the Bhangore khal fishery at Bamanghata has been taken on lease from the Public Works Department of this Government for another year with a view to study the growth of some of the *bheri* fish, particularly the three following kinds, viz., *bhetki*, *bhangone* and *parsia*. Last year the experiment was carried on through a sub-lessee. Three compartments were constructed in the *bheri*, each being stocked with a definite number of a particular kind of fish whose growth was examined at regular intervals. The sub-lessee was required to submit a statement at the end of each month, showing what progress these fish had made in comparison with the previous month. In the latter stage of the experiment the reports received from the sub-lessee were found to be of practically no value. Consequently the fishery has been kept *khas* this year, and the experiment is being conducted departmentally. Compartments have been constructed and stocked with fish marked for the experiment whose growth and life habits are being duly watched under the supervision of Mr. B. Das.

58. *Fishery Survey of District.*—Mr. S. M. Mohsin was employed from December to April last in the survey of the district of Monghyr from a fishery point of view. The object of this survey is to obtain a first-hand knowledge of the present condition of the fisheries and fish supply of each district. Mr. Mohsin has collected a good deal of information, a list of all the important *jalkars* in the district prepared by him together with their approximate area and annual output of fish, being particularly useful.

59. *Miscellaneous.*—In November last a number of small-sized fish of the genus *haplochilus*, which is said to feed on mosquitos, was sent to Lahore at the request of the Sanitary Commissioner of the Punjab. Mr. B. Das, who was entrusted with this work, took with him 1,275 fish, and by a special arrangement for artificial æration managed to take the entire lot of fish from Calcutta to Lahore with the loss of eight fish only during transit. The fish are reported to have died within a short time after their arrival in the Punjab. This was probably due to the change of conditions and the great difference in the temperature.

60. No work connected with the fishery survey of the Sundarban estuaries and experimental curing of fish was undertaken during the year under report.

CHAPTER IV.

Agricultural Associations, Shows and Agricultural Demonstrations conducted by Agricultural Associations and on Government, Wards' and private estates.

61. Agricultural demonstrations and shows conducted by Divisional and District Associations and on Government and Wards' estates are the principal

means by which the department hopes to disseminate a knowledge of agricultural improvements amongst the actual cultivators. The methods of demonstration suggested in last year's annual report have been adopted by some Associations. Besides the Central Association in Calcutta there were six Divisional Associations and 30 District Associations. A new Association has recently been formed in the Tirhut Division. Each Division now has an Association of its own. The District Association at Howrah was closed, as none of the members took any interest in agricultural matters. No Associations have yet been formed in the districts of the Sonthal Parganas and Darjeeling where the people are still very backward.

62. *Provincial Association.*—Three meetings were held during the year in August and December 1910 and April 1911. Three new members—the Hon'ble Maharaja Manindra Chandra Nandi of Cossimbazar, Babu Kanak Roy of 24-Parganas and Babu Hari Har Prosad Singh of Dumraon—were added to the list. The most important matters dealt with by the Association this year were the programmes of demonstration work to be undertaken by local Associations during the current year and the possibility of using hydraulic rams for irrigation purposes in this Province. It was decided not to recommend the introduction of rams at present as the conditions of the Province were not suitable for their use.

63. *Divisional Associations.*—A grant of Rs. 1,000 was made as in previous years to the Associations in each Division who each made small grants to the different districts in their Divisions. Most of the members of the Burdwan Divisional Association undertook some definite items recommended by the department for demonstration. Very few members of the Presidency Divisional Association interested themselves in demonstrating improved methods of agriculture. The Patna Divisional Association interested themselves during the year under report in popularising among the *Koeries* in and near Patna, Bankipur and Dinapore the method of storing potato seeds under sand as a preventive against the attack of moths. The Bhagalpur Divisional Association held two meetings—one at head-quarters and the other at Sabour—where members were shown round the Agricultural College and the demonstration farm. The Orissa Divisional Association held one meeting as in previous years at the Agricultural station at Cuttack with a view to afford members and cultivators an opportunity of inspecting the farm and acquainting themselves with the nature of the experiments conducted there. The Chota Nagpur Divisional Association was successful in inducing some cultivators to adopt green manuring with *dhaincha* and the cultivation of some crops under improved methods. Five silos were constructed—four in Hazaribagh and one at Purulia—to demonstrate to the cultivators the value of ensilage.

64. *District Associations.*—On the whole, a fair amount of interest was taken in agricultural work by the members of the Burdwan, Murshidabad, Champaran, Cuttack, Angul and Sambalpur District Associations. The Birbhum and Bankura Associations did some successful demonstration work with the help of the trained cultivators. A branch Association was opened at Rampur hât in October 1910 and showed signs of much promise. The experimental farm of the Midnapore Association was abolished and the proposal to reopen it in the current year is under consideration. Very few members of the Hooghly and Bhagalpur Associations did any demonstration work. The Nadia Association was not able to take up any work, but the branch Associations at Meherpur and Chuadanga did some practical work. The Jessore Association concerned itself mainly with the question of the introduction of new profitable crops and the improvement of cattle. Two agricultural farms on a small scale have been established in Jessore by private gentlemen during the year. The demonstration work at Patna and Muzaffarpur was damaged considerably by floods. The Sambalpur Association started a demonstration farm during the year, and introduced some improved agricultural implements and seeds among the cultivators through the branch Associations. The branch Association of the Borasambar zemindari with its 34 sub-committees has made good progsess in the work of raising a fund for the free distribution of medicines for cattle diseases. The formation of sub-committees in the different circles is being inaugurated at Angul where the Association has a demonstration farm under its management. The building of the grain bank of the Hazaribagh Association was completed last year and grain is being lent to the *khasmahal* tenants. The experimental garden attached to the Government estate in Palamau has been made over to the Association, and demonstra

tions on a wider scale will be carried out from the ensuing year. Almost in every Divisional and District Association there are some members who take great interest in the development of agriculture. Amongst them Babu Basanta Kumar Mitra of Hooghly, Rai Lalit Mohan Singha Rai Bahadur of Chakdighi, Babus Rameshwar Paramanik and Kalikanand Banarji of Birbhum, Babu Tarak Nath Banarji, Babu Kanak Roy and Roy Kali Bhusan Ghose Bahadur of the 24-Parganas, Babu Jatindra Nath Bose of Khulna, Rai Purnendu Narain Singh Bahadur of Bankipur, Babu Hari Har Prosad Singh of Shahabad, Babu Jnanendra Mohan Dutt of Muzaffarpur, Mr. E. H. Hudson of Rajpur Indigo Concern, Champaran, Babu Saroda Prosad Sarcar of Madhipura in Bhagalpur, Babu Bisseswar Mukharji of Hazaribagh and Raja Baikuntha Nath De Bahadur of Balasore deserve special notice.

65. Experimental and demonstration work on an extensive scale was carried on only by the Hathwa and Dumraon Wards' estates in the Sripur and Dumraon farms, respectively. The question of a joint demonstration farm of the Banki Government estate and Dompara Ward's estate is under consideration. A farm on a small scale was started in the Delang Ward's estate in Orissa.

Demonstration work done by Agricultural Associations and in the Wards' and Government estates.

66. *Winter paddy.*—In this crop the varieties principally demonstrated with are *Samudrabali*, *Dadkhani*, *Badshabhoge* and *Banktulsi* which are recommended by this Department for their fineness and favourable outturn. Babu Jitendra Nath Bose of the 24-Parganas obtained the best outturn in *Samudrabali*, viz, 46 maunds per acre, by the application of bonemeal and saltpetre. Khan Bahadur Maulvi Muhammad Shamsuzzoha of Seekadda, Birbhum, obtained 42 maunds per acre with this variety and has introduced it among the cultivators of the Rampur Hât subdivision.

67. Fifty maunds per acre were obtained in Angul in *Dadkhani* by the application of cowdung only. It was successful in other districts also.

68. Babu Mrityunjoy Chatterji and Babu Gosto Behari Lal Singh of Ukhara in the Burdwan district obtained an outturn of 54 maunds per acre of *Badshabhoge* paddy on sandy soil with the application of cowdung only, while Babu Natabar Khuntia of Angul obtained 34 maunds per acre of this crop on clay loam without manure.

69. *Central Provinces aus paddy.*—Successful results were obtained in the districts of the 24-Parganas, Hazaribagh and Angul. Babu Jitendra Nath Bose of 24-Parganas obtained an yield of 45 maunds and Rai Lalit Mohan Singh Bahadur 32 maunds per acre with this variety.

In the Madhipura Subdivision of the district of Bhagalpur, the cultivation of deep-water paddy has been introduced with success, while the system of transplanting one seedling only in a hole is gaining popularity in Hooghly, Shahabad, Patna, Gaya and Sambalpur. In the Hooghly district Babu Basanta Kumar Mitra induced over a hundred cultivators by means of successful demonstrations to follow this system.

70. *Potatoes.*—The Naini Tal variety was successfully grown by Babu Jitendra Nath Bose in the 24-Parganas and Maulvi Zillar Rahman and Babu Mrityunjoy Lal in Birbhum. Babu Digendra Nath Mukherji obtained a yield of 150 maunds per acre by using seed imported from Kumaon by this Department, while a yield of 30 maunds per acre was obtained at Ranchi by the use of leaf manure on light loam soil. In the Patna variety the highest yield of 300 maunds per acre was obtained by Babu Ram Prasanna Mukherji of Birbhum, while Babu Troilokya Nath Chatterji obtained 240 maunds per aere. The Manager of the Syedpur Trust Estate obtained 160 maunds per acre by using seed locally acclimatised without irrigation and ridges.

71. *Wheat.*—Muzaffarnagar wheat, which is recommended by this Department, was grown in several districts successfully. Rai Purnendu Narain Singh Bahadur of Patna obtained 16 maunds per acre by green manuring with *dhaincha*, while the Superintendent, Siripur Farm, who tried the soft white

variety, obtained 20 maunds 7 seers per acre by using superphosphate with cowdung. Mr. Hay Webb of Muktapur Factory obtained 12 maunds per acre with hard wheat supplied by the Bankipur Farm, while the local variety yielded only 8 maunds per acre.

72. *Sugarcane.*—The *khari* variety was tried in different districts. Maulvi Muhammad Shamsuzzoha of Birbhum successfully demonstrated with this variety among the local cultivators. Babu Troilokya Nath Chatterji obtained 80 maunds of *gur* per acre by using cowdung only. Raja Baikanta Nath Dey Bahadur of Balasore reports that the *gur* obtained from *khari* was of superior quality. The *shamshara* varietv was tried in the districts of Bankura, Midnapore, Hooghly and the 24-Parganas. Raja Narendra Lal Khan of Midnapore obtained 60 maunds per acre with *shamshara.*

73. *Jute.*—This crop was successfully tried in the districts of Murshidabad, Sambalpur and Balasore, where an outturn of 19 maunds, 25 maunds and 20 maunds per acre was obtained, respectively. It was also grown by some members of the Angul District Agricultural Association and on the Angul demonstration farm.

74. *Groundnut.*—This crop has made considerable progress in the Orissa Division, where it was grown in 25 places in the districts of Cuttack, Balasore, Sambalpur and Angul with success. The highest outturn, viz., 0 maunds per acre, was obtained by Babu Bhagirathi Pandey of Angul

75 *Other crops* — Raipur and Jubbulpur mustard was tried in Bankura. The cultivation of Buri cotton is slowly extending and was particularly successful in all the subdivisions of the Sonthal Parganas. It was also tried in Balasore and Bankura. A yield of 2 ½ maunds per acre was obtained with *Cabul* gram in Palamau. In the Siripur Farm of the Hathwa estate an interesting experiment was made in oats by applying three maunds of superphosphates per acre in combination with green manuring with sun-hemp. The highest outturn was 26 maunds 33 seers.

76. *Agricultural Shows and Fairs.*—Mr. E. J. Woodhouse was in charge of the exhibition work in this province. He prepared a scheme for the standardization of the work which has been accepted by the department. As a result of experience gained during the previous years, three notes on suggested improvements in the shows of the province were prepared and published as Departmental Records Nos. 1 of 1909 and 1 and 2 of 1910. Five sets of circle exhibits, each containing 94 exhibits, were prepared at Sabour and issued to the Divisional Agricultural Inspectors, who went through a course of training at Sabour before the beginning of the show season. The large exhibit was also renewed and sent out to the larger exhibitions in Bihar and to the Agri-Horticultural Society's Show at Alipore. There were 23 agricultural and cattle shows held in different parts of the province. Grants-in-aid amounting to Rs. 5,800 were given to these shows. The important shows were attended by the officers of the department and the Divisional Agricultural Inspectors, who explained the departmental exhibits, the uses of various implements and the value of seeds and manure. A brief account of each show is given in Appendix II.

CHAPTER V.

Agricultural Engineering and Well-boring.

77. *Agricultural Engineer.*—No Agricultural Engineer is attached to this department. The question of appointing an Agricultural Engineer has been postponed, as there is not sufficient work to require the services of an expert engineer at present.

78. *Well-boring operations.*—Owing to the difficulty experienced in obtaining a suitable Superintendent, well-boring was confined within narrow limits. The policy of concentration in the neighbourhood of Gaya was carried out as far as possible, but there was still some demand for wells in Patna and Shahabad. The demand for borings in Gaya was not sufficient to enable the tools to be employed economically even there. Altogether 34 borings were made: 15 in Gaya, 10 in Bankipur, 4 in Shahabad and 5 in Bhagalpur.

The staff was reduced as much as possible, the expenditure during the year under report being Rs. 7,130-11-1 as against Rs. 10,310-12-5 in the previous year.

An attempt is being made to obtain a thoroughly trained Superintendent who will be able to control the work effectively and give it an impetus in the districts of the Patna Division where there is every reason to believe that it will be much appreciated.

CHAPTER VI.

Publication of Agricultural information and supply of Seeds, Manures and Implements.

79. The following leaflets were published in English and the vernaculars and widely circulated:—

(1) The rice hispa.
(2) The rice fulgorid.
(3) Sugarcane-borers.
(4) Pests of pulses.
(5) Manufacture of *gur*.
(6) Use of shallow pan for *gur*-making.

80. Besides the *Quarterly Journal* the following reports and notes were published and distributed:—

(1) Annual report of Agricultural stations.
(2) Annual report of the Kalimpong Demonstration Farm.
(3) Record No. 1 of 1909—Note on Agricultural Shows with recommendations for future exhibitions.
(4) Record No. 1 of 1910—Some suggestions as to the organisation of Agricultural exhibitions.
(5) Record No. 2 of 1910—Recommendations for the work of the department in assisting the agricultural shows of Bengal.
(6) Record No. 3 of 1910.—Notes on classification and examination of the canes at present indigenous to Bengal.
(7) Agricultural statistics of Bengal for 1909-10.
(8) Season and crop report of Bengal for 1910-11.

Supply of Seeds, Manures and Implements.

81. During the year 1,335 maunds of seeds of various kinds, 133 maunds of manures, besides 1,12,777 sugarcane cuttings, 150 pineapple suckers, 2,600 seed cocoanuts and 109 agricultural implements of different kinds were distributed by this department's Central Seed Store at Sibpur and the several farms under this Department. In the case of potatoes arrangements were made to supply the customers direct from Naini Tal and Patna, and in case of Masulipatam turmeric direct from the Madras Province. To facilitate supplies to Agricultural Associations in the Bhagalpur Division arrangements have been made to establish a seed store at Sabour in connection with the home farm, which will form an agency for all seeds, etc., supplied by the Central Seed Store.

CHAPTER VII.

Miscellaneous.

82. *Arboriculture.*—Arboricultural work under District Boards in the province continued to receive attention. A proposal is under discussion for simplifying the working plan in accordance with which the work of tree planting in each district is carried on. The form of the working plan has been settled in consultation with the Public Works Department, and District Boards are now being consulted before the matter is placed before Government. As soon as the replies of the District Boards have been received it is intended to

move Government for permission to alter the Manual and allow an index map with statement to take the place of the existing working plans. Reference is also being made to District Boards to ascertain the amount which each District Board ought to spend on arboricultural work each year, so that Government may be in a position to settle, as laid down in rule 4 of the Manual, what is the minimum annual expenditure to be incurred by each district.

During the year under report the expenditure incurred by District Boards on planting out trees, nurseries, gabions, etc., and the receipt from sale of trees, fruits, etc., were Rs. 56,990-12-5 and Rs. 18,201-5-6, respectively.

The class for the training of Overseers, Sub-Overseers and other subordinates of District Boards in arboriculture was held from the 15th August to 14th September 1910 at the Sibpur Botanical Garden. Two Overseers, 9 Sub-Overseers, 2 road-sarkars and 1 dafadar from 14 districts attended the class and all of them received the usual certificates.

83. *Rainfall stations.*—During the year one new station was sanctioned for Burdwan, three for Cuttack, one for Gaya and five for Hazaribagh. One station was closed in the 24-Parganas.

84. *Agricultural implements.*—In Appendix III is given a table of useful agricultural implements reported to have been tried in the province during the year. The use of the Meston plough, sugarcane mill and evaporating pan for boiling juice were appreciated by the tenants of some of the districts of the province. About 75 Meston ploughs are now in use in the Madhipura subdivision of the district of Bhagalpur.

85. *Expenditure.*—Expenditure on miscellaneous experiments and enquiries during the year ending 30th June 1910 other than those carried out in Agricultural stations was Rs. 1,18,805 against Rs. 1,36,860 in the previous year.

86. *Officers of the Department.*—The Deputy Director of Agriculture as usual made frequent inspections of the Agricultural stations and displayed great interest in their management and supervision. Mr. Dobbs, the Principal, was very successful in organising the work of the College. He also did good work in connection with the well-boring operations. Mr. Taylor and Mr. Woodhouse have done valuable scientific work in their own particular subjects. The latter has also done particularly useful work in connection with the exhibitions and has organised them on a very efficient basis. Of the College staff, Mr. Woodhouse, the present Principal, speaks highly of the teaching work done by Mr. S. K. Basu and Mr. H. L. Dutt's work on insect-pests. Babu N. C. Chowdhury again proved very useful in helping with the exhibition work and in other ways. Babu A. C. Ghosh continued to look after the sericultural operations with care and efficiency. The work of the Divisional Inspector and Farm Superintendents was satisfactory. Babu Shib Das Banarji, Superintendent of Bankipur Farm, and Babu Raj Nath Roy, Superintendent of the Cuttack Farm, on the whole did best. Babu N. N. Sircar, my Personal Assistant, continued to render valuable service and was of much help to me in many ways.

APPENDIX I.

Agricultural Stations, 1910-11.

Dumraon.—The Dumraon Agricultural station has an area of 30 acres, of which 22 acres are under cultivation, the rest being occupied by buildings, roads, channels, etc.; sugarcane, paddy and wheat were the main crops under experiments at this station during the year, but mustard, oats and *rahar* were also grown for seed supply. The year under review was an unfavourable one. In August and September the abnormal rainfall of 19·33 inches and 12·76 inches were recorded instead of the average of 11·08 and 8·17 inches. During the hot months the standing crops suffered a good deal for the irregularity of supply of canal water. So far as the sugarcane crop is concerned, the *khari* variety continued to maintain its superiority over other varieties, while 200 maunds of cowdung *plus* 8 maunds of castorcake per acre as a manure, and the trench system of planting, have proved themselves superior to the local practices of manuring and planting, respectively. The results obtained on the paddy crop this year again coroborate the prolificness of *Maharajya* and *Bansphul* the local varieties, and demonstrate the economy of 50 maunds of cowdung, green manuring with *dhaincha* or 34 maunds of cowdung *plus* a little castorcake as manurial applications for this crop. The "Niger" (draining off water from the paddy field in the last fortnight of September) *versus* "No Niger" experiment was tried, and the "Niger" process gave a better outturn. As regards wheat there is nothing new worthy of report. Several hard and rust-resisting varieties were indented from Pusa and grown during the year for seed purposes. The work on other crops was the same as that in previous years. A large amount of paddy and other seeds were distributed from this station. The total expenditure at this station during the year amounted to Rs. 2,758-9 and the receipts to Rs. 1,128-8 as compared with Rs. 2,539-8-6 and Rs. 1,344-8-9 in the previous year. The expenses of this station are borne by the Dumraon Raj estate, which is now under the Court of Wards, but the entire management is in the hands of the Bengal Agricultural Department.

Bankipur.—The whole area of this farm is now in process of being brought under control. Results show that we are still dealing with ununiform condition of soil. All the channels and roads have been constructed and the necessary laying out operations are now complete. A set of labourers' quarters are being built and a student cultivator from Raj Bettiah has come here to receive practical training on the farm.

Excellent crops of "paddy", "*juar*", "gram", "linseed", "khesari", "peas", "sugarcane" and vegetables have been grown on this farm, and we may look forward to its being a good distributing centre for the seeds of these crops. The farm is expected very shortly to be in full working order.

The total expenditure at this station during the year was Rs. 10,414-5-2; out of that Rs. 149-1 was refunded into the Treasury, hence the actual expenditure incurred during the year was Rs. 10,265-4-2 and the receipts Rs. 4,018-15-3; out of that Rs. 3,974-13-3 were deposited into the Treasury and Rs. 44-2 adjusted by book transfer on account of the seeds supplied to the different farms as compared with Rs. 13,622-12-6 and Rs. 2,891-5-9 in the previous year. The charges on account of this station are borne by Government.

Chinsurah.—The work of laying out the farm progressed fairly during the year. The three-quarters of the farm called A, C and D have been laid out into regular plots with channels and roads, though some amount of levelling and earthwork is still to be done. The quarter called D has not yet been laid out, but is expected to be finished during the next slack season. Block C, to which most of the experiments are confined, is becoming more uniform, as judged from the results of experiments. The main difficulty with this farm is the want of water-supply, in consequence of which the principal crop of the farm, paddy, suffered a great deal in the year under report. There is a proposal now before the Executive Engineer, Northern Drainage and Embankment Division, Bengal, to irrigate the farm from the Saraswati river which flows by the western side of the farm. A tank has been excavated in the bed of the *jheel* in block C for storing water.

The principal crops on which experiments were tried were paddy, jute, sugarcane and potatoes. The total expenditure of the farm from 1st July 1910 to the 30th June 1911 amounted to Rs. 13,929-0-10, of which Rs. 4,707-2 was spent on permanent improvements, and the total receipts to Rs. 7,542-1-6 as against Rs. 11,773-13-6, expenditure, and Rs. 4,325-4-6, receipts, of the year before.

Cuttack.—The station comprises an area of 120 acres. In the increased area, roads, water-channel and culverts have been constructed and the necessary laying out operations have been carried out. Experiments on jute, *aman* paddy, *aus* paddy, sugarcane and groundnut were carried out. The quality of jute grown on this farm is good. *Aman* paddy crop with irrigation gives better result than without irrigation. As to the quantity of water to apply, there is very little difference in the outturn between 3 inches and 6 inches. As regards the manure for paddy, green manuring with *dhaincha* gives the best result. The outturn from transplanting one or two seedlings per hole gives better result than transplanting 4 or 8 seedlings per hole. The local *aus* paddy (Benibhog) again gave the best result, while worst was obtained from Japanese variety (Kiushu). The

Mungo sugarcane produced the highest outturn ; the quality of *gur* from this variety is excellent, and there is a great demand for it locally. Groundnut continued to give economic result on poor soils. The farm also distributed a large quantity of seed during the year under report.

One overseer and four student-cultivators received practical training during the past year.

The expenditure during the year amounted to Rs. 8,643-13-6 and the receipts to Rs. 5,759 9-6 as compared with Rs. 9,750-0-3 and Rs. 4,986-15-1 in the previous year. The charges on account of this farm are borne by Government.

Burdwan.—This station comprises an area of 31 acres, of which 25 acres are under cultivation, the remainder being under roads, buildings, tanks and channels, etc. The expenses of this station are borne by the Maharajadhiraj of Burdwan. The entire management is in the hands of the Bengal Agricultural Department. The results obtained during the year only corroborated those of previous years. It has been settled that only demonstration work will be carried out at this station. The crops which have proved a success will be raised on this farm. The most important conclusions drawn out of the results of the previous years are again laid down for general information :—

(1) The Burdwan district can produce jute fibre equal to good Narainganj jute, but the employment of Narainganj seed is necessary.
(2) Jute and paddy in rotation suit the Burdwan district.
(3) The rotation of jute and potatoes is an excellent practice for the district.
(4) The application of three maunds of bonemeal *plus* 30 seers of saltpetre per acre is an economical manure for paddy.
(5) Green manuring with *dhaincha* is an economical practice in paddy cultivation
(6) The application of 20 maunds of castercake per acre is an economical manure for potatoes.

The total expenditure at this station during the year amounted to Rs. 4,999-4-11 and the receipts to Rs. 2,153-4-6 as compared with Rs. 4,089-3-7 and Rs. 1,809-13-3, respectively, in the preceding year.

Chaibassa.—The *tassar*-rearing nursery at Chaibassa in the district of Singhbum has been abandoned.

Sabour.—The experimental plots have been laid out more or less completely including the students' plots. The drainage system of the farm is not perfect yet, considerable attention should be paid to this. During the year under report a comparative trial of irrigation by swing basket and chain pump was held. The result is decidedly in favour of the latter. Other implement tests will be carried out this year. The *rahar* crop was badly attacked with the wilt disease and a large per cent. of the plants were barren. Mr. Sil, the Assistant Professor of Agriculture, and the Superintendent have selected some *rahar* with a view to breed up a strain of wilt-resistant *rahar*. The yield of paddy and of *majhigota*, especially of the latter, was very satisfactory under our conditions giving as high as 25 maunds and 16 maunds, respectively, per acre in some cases. The land has come more under control this year than in the past, and it is contemplated to carry out a three-year rotation experiment as follows :—Maize and *rahar*, green manure followed by *majhigota*, green manure followed by barley and linseed. A dairy herd of Montgomery cattle has been added to the farm. The receipts for the year were Rs. 3,032 against Rs. 3,481 of the previous year and the expenditure was Rs. 14,981 against Rs. 14,685 in 1909-10, the small income being due to the selling of the *gota* and paddy in the next financial year.

Kalimpong.—The Kalimpong Demonstration Farm is maintained by the St. Andrew's Colonial Homes with a Government grant of Rs. 5,000 a year. The total area, exclusive of *jhoras*, is 60 78 acres, of which 9·54 are occupied with roads, houses, buildings, waste ground and land under trees and bamboos, leaving 51·24 acres of land for cultivation. During the year under report 24·17 acres were under experimental cultivation as compared with 22·22 in 1909-10 The principal crops grown in the farm were maize, paddy, soy bean, wheat, buckwheat, barley, oats, etc. An experiment is also being made with English fruit-trees to find out their suitability to the Kalimpong hills. This farm is gradually becoming more suitable for accurate experimental work.

APPENDIX II.

Agricultural Shows and Fairs.

Serial number.	NAME OF FAIRS.	Locality.	Amount contributed by the Agricultural Department.	Officers of the Department who helped in the agricultural show.	Demonstration held by the Department.	REMARKS.
1	2	3	4	5	6	7
			Rs.			
1	Chinsurah Agricultural and Industrial Exhibition.	Chinsura, (Hooghly).	300	Divisional Agricultural Inspector.	Different kinds of ploughs and other agricultural implements and the manufacture of *gur* were demonstrated.	It is reported that the number of agricultural products sent to the exhibition, though larger than in the previous year, did not come up to the expectation of the Committee.
2	Alipore Flower-show of the Agricultural and Horticultural Society of India.	Alipore (24-Parganas).	...	Director of Agriculture, Deputy Director of Agriculture, Economic Botanist and two Agricultural Inspectors.	Large exhibit of the Department was shown. Demonstrations of agricultural implements and *gur*-making were made.	It is reported that those who visited the shows were satisfied with the exhibits of this Department.
3	Barasat Industrial and Agricultural Exhibition.	Barasat (24-Parganas).	200	An Assistant of the Agricultural Department.	Manufacture of *gur* with three-roller sugarcane mill and evaporating ron pan were demonstrated.	It is reported that this year the exhibits were far more interesting and numerous.
4	Basirhat Industrial and Agricultural Exhibition.	Basirhat (24-Parganas).	200	Deputy Director of Agriculture and an Assistant of the Department.	Departmental exhibits such as seeds, manures and implements were shown.	
5	Pauchthupi Kesherpahar Agricultural Exhibition.	Kandi Subdivision, Murshidabad District.	100	Head Master of the Sericultural School, Berhampore.	Sericultural exhibits were shown.	The special feature of the exhibition was the giving away of several agricultural implements as prizes in addition to money prizes.
6	Banjetia Industrial and Agricultural Exhibition.	Banjetia, Murshidabad.	300	Deputy Director of Agriculture, Bengal, and an Assistant of the Agricultural Department.	Demonstration of chain pump and *gur*-making.	It is reported that this year the competition was restricted to the district of Murshidabad only, but exhibits from other districts and provinces were also admitted.
7	Jessore Agricultural and Industrial Exhibition.	Jessore ...	300	An Agricultural Inspector.	Demonstrations of ploughs and pumps were made.	The agricultural demonstrations were much appreciated by the people. There was a cattle show, which was more successful than in previous year.
8	Khulna Exhibition.	Khulna ...	300	An Assistant of the Agricultural Department.	The uses of the various sorts of improved implements were shown to the people and *gur*-making was also demonstrated.	The agricultural products of the district of Khulna only were admitted as exhibits.
9	The Bihar Industrial and Agricultural Exhibition.	Bankipore (Patna)	500	The Economic Botanist, Bengal; Superintendent, Bankipore Agricultural station, the Divisional Agricultural Inspector and the Entomological Assistants.	Working of the several agricultural implements and the process of making refined *gur* on shallow evaporating pan were shown.	Lectures on insect pests with special reference to Mokameh *tal* caterpiller and Patna potato moth illustrated with magic lantern pictures were given by the Entomological Assistant. They were very instructive and were much appreciated.
10	The Tirhut Exhibition.	Muzaffarpur ...	300	The Economic Botanist, Bengal.	Practical demonstrations with chain pump, chaff-cutter, Meston plough and sugarcane crusher were made.	It is reported that the exhibition on the whole was a great succes and more interest was taken in it by the general public than in the previous year.
11	Sitamarhi cattle show.	Sitamarhi (Muzaffarpur).	200	Divisional Agricultural Inspector.	Demonstration of Meston ploughs.	
12	Singeshwar Agricultural and Industrial Exhibition.	Madhipura subdivision (Bhagalpur).	300	The Economic Botanist, Bengal.	Exhibition of the large exhibit of the Department.	In the agricultural section the exhibits were fairly numerous and the competition was keener this year.
13	Bausee Agricultural and Industrial Exhibition.	Banka subdivision (Bhagalpur).	100	Divisional Agricultural Inspector.	Demonstration of ploughs, pumps and *gur*-making.	It is reported that about 50,000 people came to the *mela* which proved a great success, and most of them saw the exhibits of the Agricultural Department with much interest.

Serial number.	Name of fairs.	Locality.	Amount contributed by the Agricultural Department.	Officers of the Department who helped in the Agricultural show.	Demonstration held by the Department.	Remarks.
1	2	3	4	5	6	7
			Rs.			
14	Khagra Agricultural and Industrial and cattle show.	Khagra (Purnea)	200	Divisional Agricultural Inspector.	Demonstration with agricultural implements.	The exhibits in the agricultural section were very numerous and included many superior varieties of paddy and also of prepared jute.
15	Bagdagra *mela* ...	Siliguri subdivision (Darjeeling.)	150	Ditto ditto ...	Practical demonstrations with improved agricultural implements and magic lantern demonstrations.	This is a cattle show. The demonstrations made by the Agricultural Inspectors were much appreciated by the people. The Terai *jotedars* are now being convinced that the *mela* is held solely for their benefit
16	Kalimpong *mela*	Kalimpong (Darjeeling).	500	.....	This is mainly a cattle show.	It is reported that the *mela* was on the whole a very good one, the total number of entries being considerably more than in the two previous years. The mule section was, however, very poor.
17	Dumka Agricultural Exhibition.	Dumka (Sonthal Parganas).	150	The Agricultural Chemist to Government and the Divisional Agricultural Inspectors.	Demonstrations were undertaken with Agricultural implements, such as ploughs, chaff-cutters, maize huller, irrigation pump, don, sugarcane crusher. Magic lantern slides were also shown.	The Deputy Commissioner reported that the show proved to be a thorough success.
18	Angul Exhibition	Angul	300	Divisional Agricultural Inspectors.	Demonstrations were made of Meston and Hindustan ploughs and sugarcane mills as well as *gur*-making.	This exhibition is known as the Garhjat Agricultural Exhibition. Among the root crops potatoes were very fairly and somewhat largely exhibited, although they have only recently been introduced into the district.
19	Balasore ...	Balasore ...	200	Divisional Agricultural Inspectors.	Demonstrations were made of agricultural implements.	It is reported that the exhibition was considered to be very successful.
20	Sambalpur ...	Sambalpur ...	300	The Economic Botanist and the Divisional Agricultural Inspector.	Demonstrations of agricultural implements, such as ploughs, sugarcane mills, were made.	It is reported that the attendance at this exhibition was good, and the people appeared to be interested in the exhibits.
21	Hazaribagh Agricultural fair and cattle show.	Hazaribagh ...	300	Divisional Agricultural Inspector and the Deputy Director of Agriculture, Bengal.	Demonstrations with chain pump, *gur*-making and magic lantern were made.	The lectures illustrated by magic lantern slides given by the Divisional Agricultural Inspector were much appprecmated.
22	Ranchi Agri-horticutural and Industrial Exhibition and cattle and flower show.	Old Chutia *mela* ground (Ranchi).	400	The Director of Agriculture, Bengal, and Divisional Agricultural Inspector.	Magic lantern slides were shown and demonstrations with agricultural implements, such as ploughs and water-lift, were made.	The potato exhibits were very fine, and there has been a marked improvement in the cultivation of this crop.
23	Chaibasa *mela* ...	Chaibasa (Singhbhum).	250	Deputy Director of Agriculture.	Departmental exhibits were shown and lectures illustrated with magic lantern slides were given.	It is reported that the attendance during the exhibition was very large, and the people of the district seemed to take a great interest in the exhibition.

APPENDIX III.

A list of agricultural implements and machines tested in Bengal during the year ending 30th June 1911 and of those in use which are reported to have met with success.

No.	Designation of implements.	Use.	Special advantage.	Price.	Where procurable.	Name and designation of reporting officers.	Opinion.	Extent to which used by cultivators.
1	2	3	4	5	6	7	8	9
				Rs A.				
1	Winnowing machine.	Separating dust and small chaff from grains.	Can be used for cleaning grains in the absence of wind.	200 0	Messrs. T. E. Thomson & Co., Calcutta.	Superintendent, Siripur Farm.	Can be recommended for large farms.	.....
2	Threshing machine	Threshing and cleaning wheat, barley and oats.	Far superior to the country system of treading corn by bullocks.	3,500 0	Messrs. Arthur, Butler & Co., Muzaffarpur, and Messrs. Bernad & Co., Aberdeen.	Ditto ...	A large farm should not be without it.	.....
3	Chaff-cutting machine.	Chaffing fodder ...	Superior to hand power machine; cuts about 200 maunds in 8 working hours.	450 0	Messrs. T. E. Thomson & Co., Calcutta.	Ditto ...	Can be highly recommended for large farms where large number of cattle are kept.	.....
4	Sugarcane crushing mill.	Crushing sugarcane.	Effective. Juice can be extracted in a short time with less labour and expense.	85 0 to 200 0	Messrs. Thomson and Mylne, Behia Shahabad.	Manager, Burdwan Raj; Subdivisional Officer of Narail, and Deputy Commissioner, Angul.	Good working machine and very useful.	Extensively used by cultivators.
5	Shallow pan for making *gur*.	Manufacturing molasses.	A large quantity of juice can be boiled at one time and the froth can be easily removed.	35 0 to 60 0	Ditto ...	Manager, Burdwan Raj; Subdivisional Officer of Khurda, and Deputy Commissioner, Angul.	Very useful and appreciated by cultivators.	Used largly by cultivators.
6	Challenge double-acting force pump.	Lifting water from deep tanks.	It saves time and labour and works well.	150 0 (with all fittings).	Messrs. T. E. Thomson & Co. Calcutta.	Babu Jitendra Nath Bose, member, District Agricultural Association, 24-Parganas.	One man can only work it easily.	
7	Pitcher's sport suction pump.	Pumping water from a depth of 25 ft.	Irrigation done easily from deep well.	10 0	All hardware firms.	Babu Kanak Rai, member, Agricultural Association, district 24-Parganas.	Works slowly, but useful for great depths.	
8	Cawnpore chain pump.	Pumping water from 15 or 16 ft. deep.	Works successfully	45 0	Cawnpore ...	Ditto ...	.....	
9	Hind usthan plough.	Ploughing lands...	More effective than country plough.	13 8 to 14 12	Messrs. Leslie & Co., Calcutta, and Department of Agriculture, Bengal.	Manager, Burdwan Raj, Honorary Secretary, District Agricultural Association, Bankura; Manager, Darpan Estate, Cuttack; and Deputy Commissioner, Angul.	Works satisfactorily, but too heavy for country bullocks to pull them.	Used to a very small extent, but appreciated by cultivators.
10	Sibpur plough ...	Deep ploughing and breaking soil.	More suitable and profitable than country plough.	10 8 to 13 8	Department of Agriculture, Bengal.	Manager, Burdwan Raj; some members of the Agricultural Association, 24-Parganas, and the Deputy Commissioner, Angul.	Gives satisfactory result; used in breaking and reclaiming new area; but very heavy and requires strong animals to pull them.	Used in the Pala demonstration farm, Burdwan, and demonstration farm, Angul.
11	Meston plough ...	Ploughing lands...	More effective than country plough.	4 8 to 5 0	Department of Agritulture, Bengal, and Messrs. Leslie & Co., Burn & Co. and T. Thomson & Co., Calcutta.	Manager, Burdwan Raj; Subdivisional Officers of Madhipura, Jajpur and Banki, and the Deputy Commissioner of Angul.	Works satisfactorily. It is of small size and useful for light soil.	Used and appreciated by tenants.
12	Planet junior hand hoe.	Hoeing and weeding plants.	Very useful in making ridges.	15 8 to 40 11	Department of Agriculture, Bengal, and Messrs. T. E. Thomson & Co., Calcutta.	Some members, District Agricultural Associations, 24-Parganas and Purnea, and the Subdivisional Officer of Dumka.	Very useful in a vegetable garden and in a cotton plantation. Advantage of this machine is being gradually appreciated.	
13	Eclair Vaporizer	Applying insecticides to diseased plants.	Useful for spraying; can be easily carried by one man.	50 0	Messrs. Jessop & Co, Calcutta.	Superintendent of Siripur Farm.	Can be recommended for small holidings and small farms.	
14	Maize huller ...	Separating seeds from cobs.	Saves a good deal of manual labour.	35 0	Department of Agriculture, Bengal.	Rai Lal Rajendra Singh Bariha Bahadur, zamindar, Bara Sambar	Most useful and advantageous.	

B. S. Press—15-9-1911—1863J—[illegible]—B. B. S.

REVENUE DEPARTMENT.

AGRICULTURE.

DARJEELING, THE 24TH OCTOBER 1911.

RESOLUTION—No. 1912 T.—R.

READ—

The Report of the Department of Agriculture, Bengal, for the year ending the 30th June 1911.

IN the orders recently passed for the curtailment of reports and returns, the maximum limits of the annual report of the Agricultural Department were reduced from 20 pages for the letter press and 10 pages for the appendices to 15 and 5 pages respectively. The present report is within these limits, and the headings of the chapters correspond with those suggested in the letter of the Government of India, Department of Revenue and Agriculture, No. 9—91-2, dated the 25th April 1911.

2. *Administration and staff.*—In accordance with the orders issued in October 1904, all correspondence between the Director of Agriculture and Government passed through the Board of Revenue. For administrative reasons a change has since been considered desirable, and in March 1911 the Agricultural Department with all its subordinate offices was transferred to the direct control of this Government. Mr. W. H. Buchan was in charge of the department until the 7th of October 1910, when Mr. W. R. Gourlay rejoined. The latter was succeeded on the 10th of April 1911 by Mr. W. B. Heycock by whom the present report has been submitted. Another important change in the staff of the department was that, consequent on the transfer of the services of Mr. A. C. Dobbs to the Imperial Department of Agriculture, Mr. E. J. Woodhouse, Economic Botanist, was appointed Principal of the Bengal Agricultural College, and Mr. G. Sherrard, a supernumerary officer in the Imperial Agricultural Service, came to Bengal as Professor of Agriculture, in place of Mr. Dobbs.

The proposals for the organization of a permanent staff for the Agricultural Department have been sanctioned by the Secretary of State, and are now receiving effect.

3. *Agricultural stations.*—The Chaibassa Tussar Farm has proved a failure and has been closed. Fair progress was made during the year under review in placing the existing agricultural stations on a proper footing; and a demonstration farm was started at Sambalpur on land offered by Babu Ram Krishna Behara, a member of the District Agricultural Association. Arrangements are being made for the establishment of two more farms, one at Suri, by the Birbhum District Agricultural Association, and the other in the Bettiah Wards' Estate in Champaran.

4. *Agricultural education.*—The Bengal Agricultural College at Sabour was opened on the 3rd November 1910 with 21 students. The staff of the college as originally contemplated is now complete, but arrangements remain to be made for instruction in veterinary science. The agricultural classes attached to the Cuttack, Hazaribagh and Burdwan Schools, which were of no practical value, were closed during the year. The whole question of agricultural education in ordinary schools was considered in April 1911 at a conference held between officers of the Agricultural and Education Departments. As the Sabour College is open to any one desiring an agricultural education, and no special preparation is required in order to pass the necessary qualifying tests for admission to the college, it was agreed that agricultural classes in ordinary schools should be discontinued, and that a simple course of nature study should be prescribed for such schools. It has been decided to award prizes from

the funds of the Agricultural Department to gurus and students of guru-training schools, middle schools and primary schools, for the encouragement of nature study and the study of plant life. Details remain to be settled, but it is proposed to make an experiment first in the Orissa Division. The Lieutenant-Governor in Council will watch the progress of this scheme with interest.

Cultivators' sons continue to receive practical training at the experimental stations. It is to be regretted that the local agricultural associations have not so far taken any appreciable interest in these attempts to spread agricultural education with a view to the improvement of local methods of cultivation.

5. *Research and experiment.*—Various investigations and experiments were made in chemistry, botany, entomology and mycology; and in many cases useful results were obtained. The scientific botanical work was much facilitated by the completion of the Garden Laboratory at Sabour in July 1910, and plant-breeding operations were continued successfully.

The prices ruling in Calcutta were not sufficiently high to induce the Bihar Planters' Association to undertake the cultivation of jute, except for their own requirements. But the members of the Association cultivated sugarcane on an extensive scale; and, as the season was favourable, a good outturn was received. Indigo research was continued at Sirsiah under the supervision of Mr. C. J. Bergtheil. The station was badly flooded from the 29th of July to the 5th of August 1910, an event which caused a very serious loss of selected plants; but the year's work was not absolutely wasted inasmuch as a certain amount of useful experience was gained with regard to the method of the treatment of the indigo plant in pot culture and good progress was made in the collection of indigo-yielding plants. The Belgian flax expert, Mr. E. Vendekerkhove, continued his work during the cold weather under his agreement with the Bihar Planters' Association, who are publishing a report on the results obtained.

6. *Sericulture.*—The Bengal Silk Committee continued their useful and practical operations for the improvement of the silk industry. At a special meeting held in April 1911 they came to the conclusion that the policy hitherto followed, of trying to produce an improved seed of each of the three Bengal breeds of silk worms, in the hope of producing silk equal in quality to China, Japan or Italian silk, required a change. The efforts made had not arrested the decline of the industry; and on the advice of Mr. Lefroy, the Imperial Entomologist, it was decided to give a trial to a system of hybridising under the supervision of a capable expert. The negotiations have been entrusted to Messrs. Anderson, Wright & Co., who are arranging, through their head office at Lyons, for the deputation of a French expert to undertake these duties. Another important change on which the Committee decided was the concentration of operations in central nurseries, which will afford better chances for the production of pure seed under effective supervision than small outlying nurseries where such supervision is practically impossible. Steps are being taken to give effect to this decision. It has also been decided to provide for the disinfection of village rearing houses; for, so long as the surroundings of these rearing houses are infected, it is useless to provide the rearers with pure seed. Supervisors will be trained in the central nurseries and sent out on disinfection duty as soon as their training is complete. The total sale-proceeds of the outturn of the existing nurseries amounted to Rs. 7,858 during the year under report as compared with Rs. 6,566 in the previous year and Rs. 5,874 in 1908-09.

7. *Fisheries.*—The work of the Fishery Department consisted mainly of—

(1) experiments in the breeding of carp in confined water;
(2) investigations conducted with a view to discover the spawning grounds of *hilsa*;
(3) experiments in *kheri* culture; and
(4) a fishery survey of the Monghyr district.

Much useful information has been collected, but the results so far achieved are inconclusive. The work of this department will receive an impetus when the fishery expert, whose appointment as Deputy Director of Fisheries has been sanctioned by the Secretary of State, joins in December next.

8. *Agricultural Associations, fairs and shows.*—After the institution of an Association in the Tirhut Division, each division has now an Agricultural Association of its own. Besides these, there are a Central Association in Calcutta and thirty District Associations. The Lieutenant-Governor in Council

notices with regret that the District Association at Howrah was closed as none of the members took any interest in agricultural matters. As observed by the Director, agricultural demonstrations and shows conducted by Divisional and District Agricultural Associations are most important factors in the dissemination of a knowledge of agricultural improvements amongst the actual cultivators. The report gives evidence that a fair amount of interest in agricultural work was evinced by certain Divisional and District Associations and by a few individual members of these Associations; but very much still remains to be done, and the Lieutenant-Governor in Council will be glad to see the object in view better appreciated.

Mr. E. J. Woodhouse, who was in charge of the exhibition work in this province, prepared a scheme for the standardization of the work which has been accepted. Twenty-three agricultural and cattle shows were held in different parts of the province during the year under review; they received grants from Government aggregating Rs. 5,800.

9. *Agricultural Engineering.*—Well-boring, the only work now done under this head, was unavoidably confined within narrow limits. Altogether 34 borings were made as against 38 in the previous year. An attempt is being made to obtain a thoroughly trained superintendent, and, if it proves successful, the operations will receive the encouragement which they need, especially in the districts of the Patna Division where they are likely to be much appreciated.

10. *Publication of agricultural information.*—As in the previous year the Agricultural Department published a number of reports and notes, besides the Quarterly Journal of Agriculture, and gave wide publication to leaflets in English and the vernaculars.

11. *Miscellaneous.*—The first regular wage census was taken in April 1911. The returns are now being scrutinized and a report will be published in due course. Arboriculture under District Boards continued to receive attention.

12. The acknowledgments of the Lieutenant-Governor in Council are due to Messrs. Gourlay, Heycock and Buchan for their efficient administration of the department, and also to the officers whose services have been brought to notice in paragraph 86 of the Director's report.

ORDER—Ordered that this Resolution be published in the gazette and that a copy of it, with a copy of the report, be submitted to the Government of India.

By order of the Lieutenant-Governor in Council,

J. G. CUMMING,
Secy. to the Govt. of Bengal.

No. 1976 T.—R.

COPY forwarded to the Director of Agriculture, Bengal, for information.

No. 1977 T.—R.

COPY, with a copy of the report, forwarded to the Appointment Department of this Government for information.

No. 1978 T.—R.

COPY, with a copy of the report, forwarded to the Director of Public Instruction, Bengal, for information, with reference to paragraph 4 of the Resolution.

By order of the Lieutenant-Governor in Council,

J. G. CUMMING,
Secretary to the Government of Bengal.

CALCUTTA,
The 30th October 1911.

B. S. Press—2-11-1911—4248C—820—C. W.

REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

FOR THE

Year ending 30th June 1913.

13. FEB. 1914

CALCUTTA:

BENGAL SECRETARIAT BOOK DEPÔT.

1913.

Published by the BENGAL SECRETARIAT BOOK DEPÔT,
Writers' Buildings, Calcutta.

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DEPARTMENT OF AGRICULTURE, BENGAL.

No. 8594 A.

FROM J. R. BLACKWOOD, ESQ., M.A., LL.B., I.C.S.,
Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

Dated Calcutta, the 25th November 1913.

SIR,

I HAVE the honour to submit the Annual Report of the Department of Agriculture, Bengal, for the year ending 30th June 1913. I have to apologise for being late in submitting this report. It falls due about the time of the final jute forecast, and I was working under such pressure at that time that I had to give up all other work till it was completed.

The number of pages admissible for this report under Government orders is 15, but it has been found most inconvenient to compress it into a smaller compass than 20 pages. A fuller account has been given in this report than in that of last year of the work of the Dacca experts.

I have the honour to be,

SIR,

Your most obedient servant,

J. R. BLACKWOOD,
Director of Aariculture, Bengal.

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REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

For the year ending 30th June 1913.

CHAPTER I.

ADMINISTRATION.

I was in charge of the Department throughout the year. Babu Nagendra Nath Sircar did the work of Personal Assistant till 27th August 1912, when he was succeeded by Mr. D. N Mukerjee. Mr. F. Smith continued as Deputy Director, Mr. A. A. Meggitt as Agricultural Chemist and Mr. G. P. Hector as Economic Botanist. The Fibre Expert, Mr. R. S. Finlow, went on 15 months' combined leave on 5th April last. His work is being done by Messrs. Meggitt and Hector in addition to their other duties. The Arboricultural Expert was an officer of this Department up till 31st December 1912, after which date his services were placed under the Dacca Station Committee.

In the Provincial Service Mr. J. N. Chakravarti was Supervisor of the Rajshahi Division up till 22nd January 1913, when he was appointed Superintendent of the Rangpur Dairy Farm. Babu Rajeswar Das Gupta continued as Supervisor of the Dacca Division. Two new supervisors, one an agricultural graduate of the University of Edinburgh, Mr. N. Gupta, and the other an agricultural graduate of the University of Cornell in America (Mr. Dwija Das Dutta) were appointed on probation to the Provincial Service with effect from 14th and 28th May 1913, respectively. Mr. Gupta succeeded Mr. Chakravarti in the Rajshahi Division, and Mr. Dutta was placed in charge of the Chittagong Division. It is in contemplation to appoint two additional supervisors for the Presidency and Burdwan Divisions. Babu A. C. Ghose continued throughout the year as Superintendent of Sericulture.

In the Subordinate Service Babu Jamini Mohan Biswas continued as Superintendent of the Burirhat Farm. The Superintendent of the Dacca Farm, Babu Kali Das Ray, went on leave on the 9th of May and was succeeded by Babu Tara Nath Roy, Superintendent of the Chinsura Farm. The Rajshahi Farm continued in charge of Babu Hara Kumar Guha. Babu Bhabatosh Dutta continued as Inspector of the Presidency Division and Babu Chuni Lal Mustafi was succeeded by Mr. P. G. Krishnan as Inspector of the Burdwan Division on the 10th of May 1913. Babu P. C. Sen continued to work as Entomological Collector and Babu A. L. Som as Mycological Collector. Babu Binode Lal Mukerjee was Inspector of the Mymensingh district till 3rd June 1913, when he was transferred to Rangpur and his place was taken by Babu Sytendra Lal Sen. Babu Sachindra Lall Dutta continued to work as Travelling Inspector.

In the Sericultural Department Mr. F. D. Lafont was compelled to leave India on account of illness on 31st January 1913. Mr. M. Grangeon has been appointed to succeed him and is expected to arrive in India about the end of November. Mr. M. M. Chakravarti continued in charge of the Mirganj Nursery. A new Superintendent has been appointed for the Berhampur Nursery, who has received a training in Europe.

In the Fishery Department Mr. Southwell remained in charge as Deputy Director, and Messrs. B. Das and S. M. Mohsin continued as Superintendents of Fisheries under Mr. Southwell. Two medical assistants have also been temporarily sanctioned for one year.

2. **Tours.**—I spent 138 days on tour during the year under report. The two Deputy Directors and other subordinate executive officers were constantly on tour throughout the year.

3. **New Schemes.**—The most important new items of work undertaken by the Department during the year were the following :—

(1) A scheme for demonstrating agricultural improvements to the people in an effective manner has been submitted to Government. The scheme if sanctioned is expected to reach completion in about 10 to 12 years. The greatest proportionate amount of demonstration work has been done in the Mymensingh district during the year under review. The zamindars of that district have materially assisted the Department by advances of money for demonstrating improvements requiring a certain expenditure in the first instance. The development of this demonstration scheme and the enlisting of local assistance in carrying it out are two of the chief problems now before the Department. Owing to the absence of a subordinate revenue agency in Bengal, the problem of demonstrating agricultural improvements to the people is of much greater difficulty than in other provinces.

(2) As an attempt towards a solution of the problem of improving the cattle of the province, a dairy farm was opened at Rangpur during the course of the year. It is hoped that, by the adoption of the principle of mixed farming, farms may be run at a profit and that at the same time something may be done to improve cattle. If the Rangpur project succeeds, it is proposed to open similar farms in the neighbourhood of all large towns, where the want of a good milk supply is keenly felt.

(3) During the year a scheme was inaugurated with the object of saving the silk industry of the province from decline. The central idea of the scheme is to supply all the seed cocoons needed for the province free from disease. With this object in view steps are being taken to establish two new nurseries in the district of Malda. The existing nurseries have been enlarged as far as is compatible with the supply of labour in the neighbourhood. A new nursery has been established at Bogra for exchange of seed.

(4) A considerable amount of work was done during the year to develop the scheme for the improvement of the jute forecast, which was begun last year. In place of the old system of estimates from chaukidars and Police Sub-Inspectors, a system of taking a census of jute fields by panchayats was substituted. The work of the panchayats was vigorously checked between the dates of the preliminary and final forecasts by the staff of this Department as well as by such district officials as District Officers were able to spare. A very large number of crop-cutting experiments were made with a view to assist in determining an approximately accurate normal outturn for homogeneous areas. It was found by actual experiment, what had been previously suspected, that the normal figure which had been accepted by the Department for many years was too low. Further work will, however, be necessary to test the results which have been already obtained.

CHAPTER II.

AGRICULTURAL EDUCATION.

4. The Principal of the Sabour College reports that there are two Bengali students of the 1st year in the college seven of the 2nd year and eleven of

the 3rd year. These figures show that the popularity of the College is diminishing, and this is mainly due to the fact that students are warned before entering the College that a Government appointment is not guaranteed. Agricultural education in this province is limited to nature study in primary schools. There are no agricultural classes in secondary schools. The reports submitted by the Educational Divisional Inspectors on the results of nature study in primary schools are not very encouraging. The bulk of the *gurus* are reported not to have even a hazy idea of what is meant by nature study. Although the requirements of the syllabus reduce expense to a minimum, even that minimum is very far from being attained. Most of the schools are reported to be without a suitable garden. It is, however, reported that in Jessore and Khulna 15 per cent. of the schools have made a perceptible advance in the subject, and a considerable number of school gardens have been started. In many cases it is reported that it has not been found possible to grow plants in pots. Agricultural education is one of the subjects put down for discussion at the coming Agricultural Conference to be held at Coimbatore in December. The question of establishing an Agricultural College in connection with the Dacca University Scheme was raised during the year; but it has been pointed out that the question does not arise until the Sabour College has its full complement of students. The question of the nature of the agricultural education which it is desirable to provide in secondary schools is still under consideration. The most practical suggestion put forward is that for training an increasing number of apprentices in the agricultural farms. In order to make this proposal really effective, however, it will be necessary to increase very largely the number of our farms. It will only be possible to do this to any considerable extent if the farms can be made self-supporting. A good deal therefore depends on the result of the Rangpur mixed farming scheme.

CHAPTER III.

RESEARCH AND EXPERIMENTS.

1.—AGRICULTURE.

5. **Agricultural Stations.**—There are six agricultural stations under this Department, viz., Dacca, Burirhat, Rajshahi, Rangpur, Chinsura and Burdwan. A brief account of the work done in each during the year is given in Appendix I, where a short summary will also be found of the work done in the demonstration farm attached to the St. Andrews' Colonial Homes at Kalimpong as well as of that done in the model farm at Chittagong.

2.—WORK ON FIBRES.

The following are the chief items of work of the Fibre Expert which have been in progress during the period :—

6. **Manurial Experiments.**—The experiments started in 1911 with the object of investigating the manurial requirements of jute were continued and amplified. The first crop of jute was taken off the plots in the season 1912, and was followed by *rabi* mustard in the cold weather of 1912-13. The results of the first year's experiments are now available and, so far as it is possible to draw conclusions from one year's results, go to prove that lime by itself though producing a marked effect, cannot produce a normal crop without the addition of phosphates. Moreover, the latter, while producing a marked effect on unlimed land, does not produce the full effect without lime. Superphosphate, an acid manure, while producing a considerable effect on limed land, is unable to cause more than a very moderate increase on unlimed land. It is worth noting that the average increase in the case of jute on four limed plots was 4 maunds 22 seers 2 chitaks over the yield of four plots without lime, while in the case of *rabi* mustard the increase on four boned and limed plots over four plots without bone or lime was 5 maunds 16 seers 2 chitaks. This represents a money value, *i.e.*, an increased net return, of about Rs. 43

per acre in the case of jute, and Rs. 28, at present rates, in the case of mustard.

The net monetary effect of adding lime and bone to these plots in season 1912 may therefore be summarised as follows :—

	Rs.	A.	P.
(*a*) Increased yield of jute per acre due to use of lime—4 maunds 22 seers at Rs. 9-8 per maund ...	43	3	7
(*b*) Increased yield of mustard due to lime and bone—5 maunds 16 seers 2 chitaks, at Rs. 5-4 per maund	28	5	9
i.e., total increased net return ...	71	9	4

Cost of manures.

	Rs.	A.
Lime 30 maunds, at annas 10 per maund	18	12
Bone 2½ maunds, at Rs. 3-8 „ „	8	12
Cowdung, say	7	0
Total ...	34	8

Therefore the net profit due to use of bone and lime is equal to Rs. 37-1-4 per acre.

During the current year the above experiments have been amplified, and a further series of plots laid down to test the effect of (*a*) flower phosphate against bone, and (*b*) of calcium cyanamide. The results of these are not yet available.

7. **Selection work on jute varieties.**—This work has been continued throughout the year on the lines explained in last year's report.

8. **Other fibres.**—The work on fibres other than jute was confined mainly to *sida*, *agaves*, and *rhea* :—

(1) **Sida.**—The experiments on *sida*, reported on in last year's report, were continued, and in season 1912, 1 acre was grown on the Dacca farm. The actual area cut was 2 bighas 9 cottahs and the weight of fibre extracted 7 maunds 11 seers, or 8·90 maunds per acre. This was less than in the previous year, when from $\frac{1}{10}$th acre plots yields at the rate of 12 maunds per acre were obtained. The small yield was due to a variety of causes, chiefly to heavy rain immediately after sowing which produced uneven germination. Several bales of fibre were sent to London for sale in the open market, but it is not yet known what prices have been received.

(2) **Agave.**—The experiments on *agave* detailed in last year's report are being continued, and an additional series of experiments to test the relative rate and vigour of growth of bulbils and suckers respectively are being laid down. For this purpose a collection of bulbils and suckers from single mother plants is being made and these are being planted in adjoining rows for observation.

(3) **Rhea.**—Experiments in the cultivation of *rhea* were also continued throughout the year, but call for no special comment at this stage.

3.—AGRICULTURAL CHEMISTRY.

9. Mr. Meggitt's work was directed chiefly to the following items :—

(*a*) Sugarcane work.
(*b*) Soil investigations, involving experimental field-work and laboratory studies.
(*c*) Green manuring work.

10. **Sugarcane work.**—The work included experiments relating to of (*i*) variety, (*ii*) cultivation and drainage, (*iii*) time and method of planting, (*iv*) manuring and (*v*) method of combating borer and disease, (*vi*) selection of planting material, etc., etc.

During the past five years as a result of the soil treatment adopted, thorough cultivation and a sound rotation, which includes green manuring, the outturn of cane has steadily risen from 10 to 12 tons in 1907-08 up to 30 tons per acre in 1912-13.

11. **Soil investigations.**—On the stiff red soil of the Dacca farm the use of lime and bonemeal has had a remarkable effect particularly on *rabi* cropping.

A great improvement in the physical condition of the soil on the limed areas is clearly apparent also. While *aus* paddy in the rains has responded very little, the other crops in the rotation, *i.e.*, *dhaincha*, mustard and *mati-kalai* have responded liberally to the use of lime alone, and also bonemeal alone, but the effect of the two applied together is especially marked, very considerable profit accruing from varying dressings of lime up to 30 maunds per acre when cross-dressed with bonemeal, as the following figures for the first two years' cropping of the experiment will show :—

Manuring.	Net profit over O-manure plot after deducting cost of manures.	Cost of manuring to date.
	Rs.	Rs. A.
Bones alone ...	... 12 per acre	18 0 per acre.
20 maunds lime *plus* bones	... 22 „ „	30 8 „ „
30 „ „ „ „	... 25 „ „	36 12 „ „
60 „ „ „ „	... 6 „ „	55 8 „ „

Figures are averages of four duplicate plots in each case.

The profit from those plots receiving cowdung alone, or cowdung *plus* bones, in addition to the varying lime dressings is at present much less. *Dhaincha* used as green manure on two of the blocks gave no response on the immediately succeeding mustard crop, as unfortunately the weather prevented its being ploughed in until it became very woody, but the effect was clearly marked on the *aus* paddy crop of the second year. It is intended to continue these experiments for the full 6 years originally contemplated, and to estimate the residual effect of the manuring over a number of years.

12. **New field work at Dacca.**—The success of the above experiments in certain directions led Mr. Meggitt to attempt a further experiment during the year, with the object of ascertaining the value of one single initial application of lime (in small quantity) and bonemeal. As a substitute for the more expensive bonemeal, a finely ground raw mineral phosphate was also included.

A further object of the experiment is to see in how many years a catch green manure crop of cowpea can also be taken, and what sort of a crop it makes each year.

An experiment in the use of mineral phosphate against bonemeal was also commenced on raiyat's land, and was also included by the Fibre Expert in his manurial jute scheme.

13. **Laboratory work in connection with field experiments.**—Work was taken in hand during the year in regard to the *rôle* of lime and manures used in the field, and their mutual inter-dependence for the best results in practice.

It was attempted to determine the following points :—

(*a*) The extent and depth to which the various lime dressings have neutralized the soil acidity.
(*b*) The physical effect on the soil.
(*c*) The immediate *role* of applied lime.
(*d*) The effect of lime on the availability of applied insoluble phosphates.

Mr. Meggitt found that the neutralizing effect of lime dressings is not exerted to any appreciable extent below the depth to which it is mixed with

the soil during cultivation, but that the physical effect of descending bicarbonate of lime is marked to a lower level. These facts have a very evident bearing on the practice of liming. Again, though large initial dressings of lime of 1 or 2 tons per acre cause a very slight temporary increase in the amount of carbonate of lime in the cultivated layer, it is very fugitive, so that some 12 months after application no increase could be detected in these plots over that in the non-limed soil. By this time the 1 ton lime plot at Jorhat had again become acid, though it was faintly alkaline at Dacca. In both cases the 2 ton lime plot was still alkaline. These facts shed some light as to the amount of lime that will be required to provide even a small working reserve of carbonate of lime in the soil, a very desirable thing in a region of permanently acidifying conditions.

Further examination showed that the added lime had combined with the acid organic matter of the soil, neutralizing and fixing it and giving rise to desirable lime compounds in the result, whereas the unlimed soil gave a dark liquor when shaken with dilute ammonia, after liming it only did so after a preliminary acid digestion. The improved cropping power of the soil which accompanies this change in the condition of the organic matter points to this simple test as a reliable auxiliary in deciding the necessity for liming and what is a safe amount to apply. Considered in relation to improved cropping capacity, laboratory tests of the variously limed plots go to show that while most of the crops grown do best when the soil acidity is fully neutralized, in the case of *aus* paddy acidity as commonly met with seems to have no ill-effects. Work on the effect of lime dressings on the availability of bonemeal in the field so far goes to show that the availability increases with the larger lime applications.

14. **Green manuring.**—Work on green manuring was continued during the past year, with a view to discovering those green crops best suited to meet certain conditions, *e.g.*, of soil, period of season and growth power to resist water-logging, etc. *Dhaincha*, *sunn* hemp, cowpea and *matikalai* have been further studied and compared along several lines. The amounts of green matter, organic matter, and nitrogen per acre for both tops and roots have been determined for the above crops, and in some cases these determinations were made for the same crop at different stages of its development.

(*a*) **Dhaincha,** if sown early and ploughed in before it gets woody, is an excellent green crop, producing large amounts of green matter and nitrogen per acre, and decaying rapidly if ploughed in some 3 to 4 feet high. Such a crop supplies upwards of 6 tons green matter, 60 to 70 lbs. nitrogen, and rather more than 1 ton of dry organic matter. If allowed to get woody the percentage of nitrogen falls, and it decays very slowly, so that the immediately succeeding crop is not benefited, sometimes the reverse, the effect, however, becoming apparent in later cropping. It has a very strong root system and is better than any other crop for opening out stiff sub-soils.

(*b*) **Sunn hemp** does well on lighter types of soil, but not so well on stiff damp soils as *dhaincha*. An equal sized crop adds similar amounts of nitrogen and organic matter to the soil, but *sunn* has the same limitation as *dhaincha* as regards becoming woody. It does not make such good root development as *dhaincha* under adverse soil conditions. Decay proceeds rapidly if the crop is ploughed in in good time.

(*c*) **Jubbulpur sunn** proved superior to the local variety on all counts.

(*d*) **Matikalai** is a useful green crop, slower in growth than cowpea and does not do so well on poor soils, is apt to become more woody if left, and does not decay so rapidly. A good crop will give up to 7 tons green matter, 70lbs. nitrogen and over a ton of dry organic matter per acre.

(*e*) **Cowpea** has proved the most generally useful and applicable green crop. Though doing best on light loamy soils, it still makes fairly heavy crops on stiff land. Sown thickly (25 to 30 seers per acre) on land in fair condition, cowpeas will within two months in the rains produce a dense smothering crop, choking weed growth, while the soil surface becomes covered with a mulch of decaying fallen leaves, forming an effective soil mulch some time before the crop is ready for turning in. Except at a very early stage, when all are succulent, the proportion of soft succulent easily decomposable vegetation to the whole crop is very much greater in the case

of cowpea than with either *dhaincha*, *sunn* or *matikalai*. The crop decays most rapidly in the soil, a month being sufficient if the soil is moist even for a heavy crop. Though making fair growth on some soils, it does much better after liming. After the crop is 6 weeks old it becomes impossible to turn it in with the plough, as the trailing vines drag up in front. On small areas it can be turned in quite easily with the *kodali*. A good crop supplies some 7 tons green vegetation (containing 0·5 per cent. nitrogen), 80 lbs. nitrogen and well over a ton of dry organic matter per acre.

It has a very wide growing season and may be sown any time after the early spring rains until August with the certainty of getting a crop, though the earlier sown crops naturally give the biggest outturn. Late sown crops should be seeded down thickly. It is the only green crop it has been found possible in normal seasons to take as a catch crop on high land, after harvesting *aus* paddy, as a preliminary to *rabi* cropping, 8- to 10-anna crops being possible in this way within a period of 6 to 8 weeks' growth, unless the paddy is late in ripening. If an early ripening *aus* paddy be grown, it has been proved at Dacca that it is possible to sow the cowpea by the third week in July, the result being a thick 8-anna crop ready for turning into the soil by the end of August, thus allowing plenty of time for decay and preparation of the land for *rabi* cropping. Experience has shown that some time must elapse between turning in a green crop and sowing a *rabi* crop, so that when *rabi* crops are to follow, the green manure must be turned in certainly not later than about the middle of September, and earlier than this is still better. Owing to the long sowing season, the rapid growth of the crop, and the relatively large amount of easily decomposable vegetation produced, as also its usefulness as a catch crop, the cowpea is certainly the most useful green crop tried and capable of a much wider application than the others.

4.—BOTANY.

15. Mr. Hector was in charge of the Botanical section throughout the period under report.

16. The wells in the Botanical area have been fitted with chain pumps, and a *pucca* threshing-floor has been laid down behind the laboratory for dealing with the various crops grown. The whole area has been surrounded with hedges of *mendhi* and *duranta*, and several improvements have been made in the drainage of the area. The following work was done :—

(1) **Rice.**—It has now been proved that natural cross-fertilization takes place to a much greater extent in rice than was at first supposed. During the season 1912 11 cases of splitting crosses were proved within the area and a considerable number of variant plants, some of them undoubtedly natural crosses, were found in the pure line plots. Seeds of these have been sown and transplanted during the present season. Some cross-fertilization work, with the object of determining the mode of inheritance of certain characters in rice, was also started and a few successful crosses obtained. A classification on the basis of morphological and field characters is now being drawn up, and it has been seen that these characters are very constant in pure line cultures under uniform conditions. Work has also been commenced, in conjunction with the Agricultural Chemist, with the object of determining how far the composition of the grain is correlated with the above characters. In Bengal, the most important consideration with regard to paddy is the yield per acre, and special attention is being paid to high-yielding types. This year arrangements have been made for a test on a practical scale of the yielding capacity of some of the best types of paddy. Experiments have also been started to determine the effect of the specific gravity method of seed selection of the yield of *aus* paddy. It consists in simply throwing the seed before sowing into a saturated solution of salt and in rejecting all the lighter grains which float. This

method is widely followed in Japan. The result of the above experiment will be available during the coming season.

(2) **Oil seeds.**—A collection of varieties of *til* from other provinces was obtained, and these were sown in small plots in the Botanical area, alongside local types, with the object of comparing their outturn and oil content. Heavy rains, however, greatly damaged some of the plots making all comparison useless. The work of isolating varieties of rape, sarson and mustard was continued and a trial was made of two varieties of rape, a tall late and a short early variety. The yield of the former is nearly double that of the latter, but there is no difference in oil content between the two varieties.

(3) **Matikalai and Mung.**—Several distinct types of *matikalai* and *mung* have been isolated and are being tested.

(4) **Chillies.**—Work on the varieties of chillies cultivated as field-crop in the province was continued, and the extent to which cross-fertilization takes place between varieties was studied.

(5) **Green manuring.**—Green manuring on double-cropped land is open to the objection that it ordinarily means sacrificing one of the crops. If, however, a quick-growing green manure crop can be sown after harvesting *aus* paddy and ploughed in sufficiently early to allow of sowing the subsequent *rabi* crop, the objection does not hold. Cowpea was selected for this experiment and a very striking result was obtained. The work is being continued this year on a larger scale.

(6) **Fruit.**—The fruit area was ploughed, weeded and irrigated in the dry weather and two lines of Australian figs, brown Turkey and white Marseilles were planted out. All the trees except citrus fruits are doing fairly well. Most of the pineapple suckers planted in 1911 fruited this hot weather, and one variety, the queen, produced fruit of excellent quality. Experiments have been started to test the relative worth for preparation purposes of root suckers, leafaxil suckers and crowns of the fruits.

(7) **Other work.**—The distribution of Garo Hill cotton seed in the Chittagong Hill Tracts was continued. Last year, 4 maunds of seed were grown on three separate *jhums*, but late sowing and heavy rain after sowing caused bad germination, and the results were indeterminate. Last year liming was found to delay the appearance of the *ufra* disease of rice, but in the end limed and unlimed plots were equally affected. This year under the recommendation of the Imperial Mycologist the effect on the disease of stubble burning and thorough cold-weather cultivation is being experimentally studied. It is broadcasted winter paddy on low lands subject to annual floods that suffers most from *ufra*. An attempt is being made to grow *aus* paddy on these lands followed by transplanted *aman* paddy as the flood-water subsides.

5.—ENTOMOLOGY.

17. The Imperial Entomologist at Pusa received, during the year under report, specimens of insects or of plants affected by insects from various people in the province. The pests were identified, and remedial measures suggested where necessary. Among others, (1) tea twigs and leaves affected by an insect allied to *Lecanium hemisphericum* were received from Mr. F. F. Partridge; (2) specimens of a bug found in the Cinchona Plantation in Bengal were sent by the Superintendent of the Royal Botanic Garden, Sibpur, for identification. These proved to be examples of *Disphinctus humeralis;* (3) three specimens of a weevil, the grubs of which damaged mango trees in the Botanic Garden at Dacca, were sent by the Entomological Collector for identification. The weevil was identified as *Alcides* sp; (4) remedial measures against the ravages of *Euguamptus marginatus* were suggested to the Assistant Secretary, Agri-Horticultural Society of India, Alipore. Shaking the beetles off the branches and killing them and spraying the infested trees with lead chromate were recommended.

The Entomological Collector also attended the agricultural shows at Tangail, Suri, Khulna, Bongong and Kurigram, where the insect-pests were shown and their life-history explained to the visitors, and the use of entomological appliances, such as spraying machines, field bag, fumigating box, etc., were demonstrated.

6.—MYCOLOGY.

18. During the year under report the Imperial Mycologist investigated the following diseases of Bengal crops in his laboratory at Pusa :—

(1) **Paddy diseases.**—The disease known as *ufra*, the presence of which was reported in a large portion of the Dacca district and which was also found to exist in Comilla and Noakhali, was duly studied and a full account of the work up to date is being published. Experiments during the year have established that it is caused by an eelworm of the genus *Tylenchus*, allied to worms which cause well known diseases of other cereals, and its best remedy appears to be the destruction of the worm, when in a passive condition, after harvest, by burning the stubble. A small area near Comilla was selected for carrying out experiments. An attempt is being made to work out a feasible scheme to deal with the evil. The problem is, however, one of much difficulty.

(2) **Sugarcane diseases.**—Several important sugarcane diseases have been studied, and an account of them prepared for publication.

(3) **Root-rot caused by Rhizœtonia.**—This is practically the only fungus disease of importance which affects jute. A full account of it was published during the year.

(4) **Mildews of Caston and Colocasia.**—The investigations of these diseases caused by species of *Phytophthora* were concluded and the results published.

(5) **Potato blight.**—This disease was destructive at Rangpur, probably due to large import of hill seed at the beginning of cold weather. The parasite (*phytophthora infestans*) has been obtained in pure culture and its temperature relations are being studied as it is in this direction that its control is most hopeful.

(6) **Anthrænose of betle pepper.**—The disease which causes much damage in certain localities is apparently caused by an undescribed species of *Colletotrictum*. Its parasitism is being investigated.

The Mycological Collector under the Department also devoted a good deal of his time to studying the *ufra* disease of paddy, the potato and tomato blights caused by the fungus *phytophthora infestans*, which did much damage to those crops in the Rajshahi Division last winter, and also the wilt disease of plantain or banana prevalent in the Burdwan Division and in the Munshiganj subdivision of the Dacca district. The spraying of Bordeaux mixture as a preventive measure against potato blight was demonstrated to raiyats.

The Mycological Collector also attended exhibitions at Birbhum, Khulna, Bongong and Kurigram in which specimens of the more important parasitic fungi prevalent in the province were exhibited, their life-history explained, and instructions given to the visitors as to the best method of checking them. A number of important fungi on both economic and wild crops has also been collected and identified, and specimens of the same have been prepared and kept in the herbarium for reference.

7.—SERICULTURE.

19. The Director was assisted, as in previous years, in the management of this Department by the Bengal Silk Committee. Four regular and two special meetings were held during the year. At one of the special meetings the Hon'ble Member, Mr. P. C. Lyon, presided, and a decision was arrived at

as to the lines on which the new scheme for saving the silk industry should proceed :—

(1) **The new scheme.**—The object of the scheme is to work up gradually to a point at which the whole of the seed cocoons necessary for the province will be supplied to rearers under Government supervision. It is believed that this is the only really effective method of dealing with the problem. With this object in view it has been decided to establish gradually a sufficient number of nurseries throughout the silk districts of the province. A considerable income will be derived from these nurseries, but it has been calculated that, unless a rate of Re. 1-8 per *kahan* or more can be obtained for seed, the nurseries are not likely to pay their own expenses. With a view to estimating the number of nurseries which will ultimately be required, a census of mulberry fields will be taken by the agency of Panchayats. It has been decided to make these nurseries as large as possible. Their size is, however, limited by the number of labourers available in the neighbourhood. With a view to giving effect to this idea, a number of the smaller nurseries were sold in the course of the year ; and such smaller nurseries as it was decided to retain were converted into large nurseries. The following nurseries were in consequence sold in the course of the year :—

(1) Saktipur.
(2) Harirampur.
(3) Baneswar.
(4) Khorkhory.
(5) Rambate.
(6) Sripur.
(7) Rajdharpur.
(8) Raghunathganj.

Steps were taken to enlarge and improve the Chandanpur nursery and similar steps will be taken in the coming year with regard to the Kumarpur nursery. In the Malda district 173 bighas of land have been acquired for starting a new nursery at Piasbari, and steps are being taken to acquire land for another new nursery at Amriti in the same district.

(2) **Cross-breeding experiments.**—Owing to ill-health, the French Expert, who was appointed in January of last year to investigate the possibilities of cross-breeding, was compelled to return to Europe. In his place another French Expert, who has had experience of silk work in Madagascar, has been appointed and will take up his duties some time this cold weather. The object of the investigation is, if possible, to establish a multi-voltine hybrid of European quality.

(3) **Disinfection of village rearing-houses.**—It is not sufficient merely to provide seed free from disease to rearers. Care has to be taken to see that the villagers' houses are freed from disease germs before pure seed is introduced into them. A number of overseers are at present under training for the purpose of seeing that this important matter receives full attention.

(4) **Sericultural education.**—The sericultural class attached to the Berhampore nursery was continued during the year. There were six students, of whom two passed the final examination and received a reward of Rs. 250 each to enable them to build model rearing houses. One of these students has already completed the construction of the house. The Rajshahi Sericultural School is controlled by a managing committee which held four sittings during the year. Steps were taken during the year to extend the area under mulberry cultivation. Three students passed the final examination in December 1912 and were granted Rs. 100 each as the first instalment of the reward of Rs. 250 for the purpose of enabling them to erect model rearing-houses. At present there are eleven pupils in this school, seven being Muhammadans and four Hindus. Three crops of cocoons were raised during the year, eight *kahans* of which were kept for microscopic examination purposes, and the rest was sold for seed to cocoon rearers. The receipts from this source came to Rs. 209, while the expenditure on the school was Rs. 3,686. In the course of the year the school was visited twice by the Director of Agriculture, four times by the Superintendent of Sericulture and three times by the Superintendent of Mirganj.

(5) **Income and expenditure.**—The total expenditure on this Department in the course of the year was Rs. 61,372-12, and the income derived

from it was Rs. 8,589-10. It is hoped that, as the new scheme develops, this large excess of expenditure over income will be gradually diminished.

8.—FISHERIES.

20. The fishery officers under the Department were in charge of the fishery investigation work in Bengal as well as in Bihar and Orissa. Their work during the year under review, may be classified under three distinct heads, viz :—

I. Experimental work,
II. Demonstration, and
III. Laboratory work.

I.—The experimental work of the fishery officers was mainly confined to carp and *hilsa* culture.

Carp culture.—The object of this experiment is to ascertain why the Indian carp (to which class belong *rohu*, *katla*, *mrigal* and *calbasu*) do not breed in confined waters, although they do so freely in other parts of the world. Most of the experimental stations for the breeding of the carp were located in Bihar and Orissa, where local conditions are more suitable than in Bengal for carrying out the experiments. Berhampore was the only place in this province where the experiment was tried on a considerable scale.

The investigation in future years, as the Deputy Director of Fisheries points out, will not be directed to induce carp to breed in tanks, but to find out why they become impotent when placed in stagnant waters.

Hilsa culture.—In September 1912 a *hilsa* hatchery was established at Monghyr, the object being to rear *hilsa* eggs to the fingerling stage and then to liberate them in the river. This work is carried on extensively in America where it has met with unparallelled success as a large commercial enterprise. The success of the hatchery depends on the station being fixed near the breeding grounds. Monghyr was chosen, because Mr. Mohsin (who had been in charge of *hilsa* culture during the previous two seasons) was of opinion that the breeding grounds were in the vicinity of that place. This presumption, however, proved to be incorrect, with the result that no ripe male was obtained. Consequently the eggs could not be fertilized. Whether the breeding grounds are situated higher up in the Ganges or these change from year to year cannot definitely be ascertained without further investigation. A steam-launch is necessary for the purpose. A survey is in course of preparation by the Deputy Director of Fisheries regarding the distribution of *hilsa* in the Ganges, Brahmaputra and other rivers and the intensity of its occurrence, the object being to define the limit of distribution and to publish the information in map form. The intensity of distribution is expected to give very valuable clues as to the places where the actual search for the breeding grounds should be made.

II.—Demonstration work consisted mainly in propaganda work carried out by the Fishery officers. The improvement and development of the fisheries in general is dependent, in a very large measure, on the improved education of the fishermen as a class. At every place visited by the Deputy Director or the Superintendents of Fisheries, the fishermen were mustered and information spread broadcast. Wherever possible, actual demonstrations were given, particularly in salting and smoking fish, and in the transport of fresh fish from place to place. Pamphlets dealing with fish-curing, fish transport, stocking tanks, etc., have been printed in vernacular languages and distributed freely among the fishermen, and their contents verbally explained to them. Salting and curing of fish wherever practised in the province is of

a crude nature and the cured product has nearly always an offensive smell. But markets are established for the fish as they are now cured. The adoption of improved methods of curing as followed in western countries necessarily means the creation of new markets. The initiation of a change will, therefore, occupy a considerable time.

III.—The laboratory work of the Fishery Department was carried on in the laboratory located in the Indian Museum. The following work was done :—

(1) Large numbers of tank fish were identified and named.

(2) A large number of fish parasites were collected and named. In many cases the species were new and in two instances new genera were established. Among the parasites two are particularly worthy of notice, viz.:—

(*a*) A parasite named *Ligula simplicissima* was found to be common in the abdomen of certain Bengal carp, such as *rohu* and *katla*. It is a larval tapeworm and often measures 18 inches long (occasionally 1 yard) and about 1 inch broad. The adult of this larva is found in the intestines of certain birds living in the vicinity of tanks and feeding on the infected fish. The mature parasite passes millions of eggs with the bird's fæces, and these dropping in tanks reinfect the fish. Owing to the absence of running water the infection is cumulative, and there is no doubt that the attendant mortality is fairly large. The remedy is to destroy the birds which carry the infection.

(*b*) A larval trematode was found to normally live in the ovary of a certain fresh water "Perch" (*Nandus marmoratus*) common in the Ganges. Hundreds of specimens of this parasite exist in a single fish. Each parasite attaches itself by means of its sucker to a single egg which is destroyed. It is estimated that about 10 per cent. of the eggs of this fish are destroyed *in situ*. No remedy appears to be possible.

(3) The nature of "fish pox" in Bengal fish was determined. This is a fatal disease caused by what appears to be a *myxosporidian*. The mortality is not due to this parasite, but to a fungus which attacks the small lesions caused by the bursting of the spore sack of the primary parasite.

(4) Hundreds of specimens of the milt and eggs of *hilsa* were examined. In most cases the milt was not mature. It consisted of clots of mother sperm-sells.

(5) An examination was made of the eggs and milt of some 70 carp which had failed to breed in tanks. In many cases it was found that the gonads had not developed fully, but cases were occasionally noted where the gonads had increased sufficiently in volume, but the actual ripening processes had not taken place.

(6) About 28 species of mosquito larvæ-eating fish were identified and their habits studied.

21. **Miscellaneous.**—The Fishery Department sent its exhibits to a number of agricultural shows. The exhibits consisted of :—

(1) growth stages of carp from the egg to the adult and of *hilsa* from the egg ;
(2) differences between male and female fish ;
(3) a collection of the principal voracious fish and several species of mosquito larvæ-eating fish ;
(4) samples of salted and smoked fish, prepared on the spot ;
(5) fish oil in three grades of purity, isinglass and other bye-products of fish ;
(6) certain common fish parasites.

Besides the fishery exhibits, actual demonstrations were given at each place in salting and smoking fish; and the fishermen attending were taught

methods of transport of fresh fish from place to place, and the utilization of waste products on a small scale.

A full and careful investigation has been made of the fish trade in general throughout the province, the possibility of developing this trade in the mufassal, and the supply of fish to Calcutta. The Government tanks at Dacca have been stocked with fry, and an attempt is being made to run these tanks on business lines. It is also proposed to stock the mountain streams with trout.

Arrangements have been made by the Deputy Director of Fisheries to give a series of 8 or 10 lectures every year to the students of the Sabour College on practical fish-culture in tanks in order to teach the students how to make use, commercially, of tanks and water areas which may later on be in their charge.

In the absence of a launch the work of investigating the estuarine fisheries in the Sundarbans could not be undertaken, and the question of dealing with fish bye-products and curing cannot have much importance until the marine fisheries are developed. The purchase of a launch has, however, been sanctioned by Government, and it is hoped that it will be ready for work during the cold weather.

As regards fishery laws, the enforcement of a close season or any other measure cannot be suggested until the life habits of the various fresh water species have been fully studied. But at present the information of the Department does not extend beyond a few important details regarding carp and *hilsa*.

CHAPTER IV.

AGRICULTURAL ASSOCIATIONS, SHOWS AND AGRICULTURAL DEMONSTRATIONS CONDUCTED BY THIS DEPARTMENT, AS WELL AS BY THE AGRICULTURAL ASSOCIATIONS AND PRIVATE PARTIES.

22. During the year under report extended use was made of local agency as a means of exhibiting agricultural improvements to the cultivators. In particular a strong effort was made to enlist the support of zamindars, who are the most effective agency at the disposal of the Department. Agricultural Associations exist in all the districts of Western Bengal and in three of the districts of Eastern Bengal, which also has nine agricultural associates. These agencies are useful, but insufficient for dealing with the difficult problem of inducing cultivators to adopt agricultural improvements. There was also an increase during the year of the number of Government demonstrators especially in the Mymensingh district; and it is in contemplation to still further increase their number as soon as suitable men can be trained on the Government farms. It is believed that this method of exhibiting agricultural improvements will prove more effective for the purpose of securing this particular object than the establishment of additional demonstration farms. It is further in contemplation to utilize co-operative credit societies for the purpose of financing members of those societies in cases where the agricultural improvement involves the expenditure of some small amount in the first instance. These societies, however, are not at present in a sufficiently advanced state to incur expenditure on any considerable scale for productive purposes.

23. **Agricultural Associations.**—In addition to the Provincial Agricultural Association, there are 2 Divisional Associations, 13 District Associations and 5 Branch Associations as shown on the margin. During the year under report the Malda Association was formed and the question of forming associations in

DIVISIONAL ASSOCIATIONS.

1. Burdwan. | 2. Presidency.

DISTRICT ASSOCIATIONS.

1. Burdwan.	8. Jessore.
2. Birbhum.	9. Nadia.
3. Bankura.	10. Murshidabad.
4. Hooghly.	
5. Midnapore.	11. Bogra.
6. 24-Parganas.	12. Rangpur.
7. Khulna.	13. Malda.

BRANCH ASSOCIATIONS.

1. Kushtea
2. Ranaghat
3. Chuadanga } in Nadia district.
4. Meherpur
5. Rampur Hât in Birbhum district.

the other districts of Eastern Bengal is under consideration. There are also a number of honorary correspondents and associates in the Rajshahi, Dacca and Chittagong Divisions.

24. **Provincial Association.**—Owing to the reconstitution of the Province the old association was dissolved and a new association was formed, composed of such members of the old association as belong to the Province as now constituted. Ten new members were elected. Mr. J. Mackenzie was appointed the representative of the Jute Mills' Association. Nine agricultural associates of the Eastern Bengal districts, who expressed their willingness to join the association, were elected members. Two meetings were held during the year, one in July and the other in December 1912. New rules on the lines of the old rules with a few modifications were drawn up and approved.

25. **Divisional Associations.**—A grant of Rs. 1,000 each was made as in previous years to the Burdwan and Presidency Divisional Associations, which in their turn made small grants to the different district associations in their divisions.

Only 4 out of 19 members of the Presidency Divisional Association interested themselves in demonstrating improved methods of agriculture amongst their tenants. A similarly small proportion of the members of the Burdwan Divisional Association took any practical interest in the work of the Association.

26. **District Associations.**—The Burdwan Association did a certain amount of useful work during the year in bringing to the notice of cultivators in the interior of the district the advantage of the use of bonemeal and of *dhaincha* as a green manure. The Birbhum Association constructed a *pucca* godown for storing seeds and implements. No demonstration work was, however, carried on by any member of the Rampur Hât Branch Association. Some of the members of the Bankura, Midnapore, 24-Parganas, Nadia, Murshidabad and Bogra Associations took up certain items of demonstration work partly in the fields of the members themselves and partly in the fields of cultivators. Only a few members of the Hooghly Association took any real interest in the work of the Association. The Jessore Association has been doing its best to overcome the prejudices and conservatism of the people. The private farm at Murali in Jessore is reported to have done useful work, although it is working at a loss. The Khulna Association started an experimental farm on a small scale, and distributed *dhaincha* seed to the raiyats. The Rangpur Association was reorganized during the year, and it was very active in carrying out the demonstrations recommended by the Department. Several maunds of seed and manures and a large number of improved implements were purchased and distributed through this Association to the cultivators in the district. It was also helpful to the Director in assisting him to start the new dairy farm. The Malda Association was started only in April 1913, and it began its carier by distributing some seeds and manures to the cultivators. In Chittagong an association was started in July 1912, but it did little work.

27. **Demonstration by Government demonstrators.**—A considerable amount of demonstration work was done through the direct agency of officers of the Department. Although the help of local persons of influence is indispensable for the purpose of carrying on this work, it will not be possible to dispense altogether with a Government agency ; and it is proposed therefore to further extend this system until we have a Government demonstrator in every thana in the Province. During the past year a considerable amount of attention was devoted to the district of Mymensingh, as the zamindars of that district were good enough to render considerable assistance by advancing money for the purpose of bonemeal. In the other districts of Eastern Bengal there is now approximately a Government demonstrator in every subdivision, but the system has not yet been extended to Western Bengal. It will be necessary to train more men before any further extension of the scheme is possible.

The following were the chief items of demonstration exhibited during the year under review :—

(a) **Bonemeal demonstrations.**—By way of popularizing the use of bonemeal as a manure for jute and paddy certain quantities were given free

to raiyats under the supervision of fieldmen demonstrators of the Department. These demonstrations were given in Dacca, Narainganj, Comilla, Hili (Dinajpur), Bharenga (Pabna) and in Rangpur. The results were so satisfactory that several zamindars of the Eastern Bengal districts have now advanced money for the supply of bonemeal to their raiyats on the understanding that the manure is to be used under the supervision of the Department. The raiyats are expected to have in the increased outturn of their crops a good margin over the value of the manures, and the money will be subsequently recovered from them. The bonemeal demonstration work on these lines has been started on a considerable scale in the Dacca, Rajshahi and Chittagong Divisions.

(b) Demonstration in the cultivation of Hill potatoes.—In many districts in Eastern Bengal potatoes are very sparingly cultivated, and where they are cultivated at all the crop has seriously degenerated. The Department is trying to show the raiyats the advantage of growing hill varieties by distributing small quantities of seed to selected men and growing the crop according to improved methods under the supervision of fieldmen demonstrators. These demonstrations were carried out in Dacca, Mymensingh, Faridpur, Bharenga, Natore, Jalpaiguri and Rangpur, and the results were very satisfactory.

(c) Conservation of Cowdung.—A considerable number of cultivators have been induced to dig a pit and erect a cheap form of covering over it for the purpose of conserving cowdung. This is an improvement which involves a very small amount of expenditure, and it is probable that there will be little difficulty in extending it widely.

(d) Seed selection.—The ordinary practice of cultivators is to use the crop of any field indiscriminately for seed. Where a certain amount of loss is incurred in utilizing a crop for seed, there is a natural aversion on the part of the ordinary cultivator to utilize the best stalks for seed. This is particularly so in the case of jute. There is therefore a wide field for useful effort in this direction. and a considerable amount of work has been done by the Government demonstrators in marking down the best stalks of jute and paddy for seed. They are also present at the time of harvesting the crop for the purpose of instructing cultivators to lay aside the seed of the best stalks of the crop.

28. **Some results obtained by members of Agricultural Associations.**—The following results, which were obtained by members of the various associations, are classified under particular crops :—

Winter paddy.—The varieties principally used for demonstration are *samudrabali*, *dadkhani*, *badshabhog* and *balam*. These are recommended by this Department on account of their fineness and good yield. Babu Rama Prosanna Mukerjee and Lala Mrityunjoy Lal of Birbhum obtained good results in the case of *dadkhani* paddy. Khan Bahadur Mahammad Shams-uz-zoha of Sekeda (Birbhum) tried the *samudrabali* and *dadkhani* varieties and obtained 21 maunds of grain per acre in each case. Babu Basanta Kumar Mitra of Hooghly obtained an outturn of 30 maunds of *dadkhani* paddy and 27 maunds of *badshabhog* paddy per acre. He also tried the *parmannasal* variety of Burdwan and the *piplibash* variety of Mourbhunj and obtained fair outturns. Babu Prio Nath Mukerjee of Jessore obtained an outturn of 56 maunds per acre of *dadkhani* paddy with the application of cowdung after ploughing in *dhaincha* as green manure. Babu Ashutosh Lahiri of Rangpur tried the *badshabhog* and *kataribhog* varieties of paddy, but the outturns did not come up to much as the crops were damaged by cyclonic weather in October last. Babu Govinda Chandra Ray of Tushbhandar (Rangpur) transplanted single paddy seedlings after green manuring with *dhaincha*, and obtained a very satisfactory outturn. Rai Mani Lal Singh Ray Bahadur, Babu Amrita Lal Sil, Babu Bhut Nath Ghosh of Burdwan and Babu Judhistir Nandi of Bankura obtained such satisfactory results with their paddy

crops from green manuring with *dhaincha* that some of their tenants are eager to follow their example. A cultivator of Chatkabaria (24-Parganas) received 46 maunds of paddy per acre with bonemeal.

Central Provinces aus paddy.—Good results were obtained by Babu Basanta Kumar Mitra of Hooghly and Babu Kulada Bhusan Bhattacharjee of Jessore. This variety was also tried by some of the members of the Nadia, Ranaghat, Chuadanga and Kushtia Associations, but the outturns were generally disappointing. Mr. B. D. Pal Chowdhury of Nadia distributed some seed of this paddy among a number of his tenants, but the results were not very satisfactory.

Potatoes.—Babu Govinda Chandra Ray of Tushbhandar (Rangpur) tried Darjeeling potatoes, but his crop was affected with the blight (*Phytophthora infestants*) and only a few plots gave a fair outturn. Babu Bhut Nath Ghosh of Burdwan grew the Cawnpur *thikra* variety with good results, the outturn being 120 maunds per acre. This satisfactory result has induced many of the cultivators of the locality to take up the cultivation of this variety extensively during the current year. The potato crop of the tenants of the Jaipur Government estate suffered from potato disease. Babu Kashi Prosad Roy, a member of the Bogra Agricultural Association, reports that one Ghuroo Nunia of Harina was so successful with his potato cultivation that he made an income of Rs. 125 from a *bigha* of land. Mahammad Abdul Majid of Gaibandha (Rangpur) obtained good results with the Darjeeling variety. With the Naini Tal variety the highest yield of 240 maunds per acre was obtained by Khan Bahadur Mahammad Shams-uz-zoha of Birbhum. The members of the Meherpur Branch Association and Babu Iswar Chandra Nandi of Chittagong were also successful with this variety. The Patna potato did well in Hooghly, Birbhum and Murshidabad. In the 24-Parganas Babu Tarak Nath Banerjee was very successful with Patna potatoes and he induced about a dozen local raiyats to take up its cultivation. The outturn obtained by him was 120 maunds per acre. All the cultivators who grew potatoes under his advice also got good outturns.

Sugarcane.—The *khari* variety of cane was successfully grown by Babu Abinash Chandra Banerjee of Birbhum, who obtained a net profit of Rs. 105 per acre. Khan Bahadur Mahammad Shams-uz-zoha of Birbhum and Babu Raghu Nath Banerjee of Bankura obtained 54 maunds and 60 maunds of *gur* per acre, respectively. Babu Basanta Kumar Mitra of Hooghly also obtained good results from the cultivation of this variety. The Java variety of cane was grown by Babu Raghu Nath Banerjee of Bankura, which yielded an outturn of 75 maunds of *gur* per acre. Babu Prassanna Nath De of Murshidabad grew the Mauritius variety so well that some of his canes are reported to have been as high as 26 feet. Some Dacca *gandari* sugarcane cuttings were distributed at the instance of the Co-operative Credit Society to selected cultivators in the Jamalpur subdivision of Mymensingh, and they have given great satisfaction. *Gandari* sugarcane has also been introduced among the tenants of the Jaipur Government estate.

Other crops.—Babu Bhut Nath Ghosh of Burdwan distributed a quantity of *uar* seed to his tenants; the plants grew fairly well and convinced the local raiyats that it can be used profitably as fodder. Fine crops of jute were grown by the members of the Meherpur, Murshidabad and Hooghly Associations. Raipur and Jubbulpur mustard continued to grow in favour in Birbhum and Jessore. Groundnut was grown with a fair amount of success in Bankura and Burdwan. Munshi Mahiruddin Mahammad of Contai obtained 15 maunds of Hingli

tobacco per acre, while the tobacco crop of the Subdivisional Officer of Contai did not grow well owing to late sowing and rain in winter. Muzaffarnagar wheat and cotton were grown with more or less success in Birbhum and Bankura. Mr. Kanak Ray of the 24-Parganas district made a few useful demonstrations, such as growing three crops on the same land in the same year—jute followed by paddy and *khesari*—and he obtained fair outturns for all the three crops.

29. **Agricultural shows and fairs.**—During the year twenty-two agricultural shows were held throughout the province. The Department contributed Rs. 4,110 in the shape of grants-in-aid. The shows were all organized by local effort, but at most of them the officers of the Department were present and gave demonstrations and lectures. As a rule the exhibitions were partly industrial and partly agricultural, and arrangements were usually made to cater for the amusement of the people of the locality in the shape of bioscope and theatrical entertainments. The tendency indeed of the committees in charge of these exhibitions is to pay an undue amount of attention to the amusement part of the programme. The explanation usually given is that, without a satisfactory programme of amusement, the exhibition would probably be a failure.

Advantage was taken of the large gatherings of people at these exhibitions to give practical demonstrations of the working of improved agricultural implements and to give lectures on various subjects connected with agriculture. At the Tangail Exhibition a number of Meston ploughs were bought as a result of the demonstration which was given. The cattle department of the exhibition was usually a failure, but at the Jajhat Exhibition, in the district of Faridpur, a number of very useful animals were exhibited. As cattle farms develop under the Department, it is hoped that it will be possible to show a certain number of superior animals at these exhibitions and set a standard of attainment for the surrounding cultivators.

A brief account of each show is given in Appendix II.

CHAPTER V.

PUBLICATION OF AGRICULTURAL INFORMATION AND SUPPLY OF SEEDS, MANURES AND IMPLEMENTS.

30. The following leaflets, bulletins and reports were published by the Department in the course of the year :—

(1) *Leaflet No. 2 of 1912.*—The Pests of *Sunn* hemp and how to check them.
(2) *Leaflet No. 3 of 1912.*—The Jute Similooper.
(3) *Leaflet No. 4 of 1912.*—Hints on the Cultivation and Curing of Tobacco.
(4) *Leaflet No. 1 of 1913.*—Rice Stemborer.
(5) *Bulletin No. 1.*—"Notes on Manures."
(6) *Bulletin No. 2.*—"Ufra Disease."
(7) Season and Crop Report of Bengal for 1911-12.
(8) Annual Report of the Department of Agriculture, Bengal, for the year ending 30th June 1912.
(9) Annual Reports of Agricultural Stations for 1911-12.
(10) Annual Reports of Demonstration Farm, Kalimpong, for 1911-12.

The publication of the quarterly journal has now been undertaken by the Agricultural Department of Bihar and Orissa, but the last number (No. 4) of volume V was compiled and published in September 1912 to complete the series of the journal for the year 1911-12.

The Fishery branch of this Department also published the following two bulletins in English as well as vernacular languages during the current year :—

(1) *No. 1 of 1913.*—Notes on "How to cure fish and the best way of preserving fresh fish from going bad during transit from one place to another."
(2) *No. 2 of 1913.*—Fish culture in tanks.

In addition to the above Mr. Southwell, Deputy Director of Fisheries, prepared the following scientific notes and reports on fishery matters in general, some of which were written in collaboration with Captain Sewell, I.M.S., Surgeon Naturalist to the Government of India :—

(1) Notes on fish fauna of certain tanks in Bengal (published by the Department of Agriculture, Bihar and Orissa).
(2) Some notes on Cestode (tapeworm) and other parasites of Indian fish (published by the Department of Agriculture, Bihar and Orissa).
(3) On some fish parasites (appeared in the Record of the Indian Museum).
(4) A report on the *hilsa* hatching operations at Monghyr (Department of Agriculture, Bihar and Orissa).

SUPPLY OF SEEDS, etc.

31. During the year under report the following quantities of seeds, manures and implements were distributed from this Department's seed-store at Sibpur as well as the store attached to the Dacca Farm :—

SIBPUR SEED-STORE.

Seeds	710 maunds.
Cuttings	950 No.
Manure	181½ maunds.
Implements	182 No.

DACCA SEED-STORE.

Seeds	261 maunds.
Cuttings	40,360 No.
Manure	75 maunds.
Implements	2 No.

The following statement shows the receipts and expenditure at the two seed-stores during the year :—

	Receipts.	Expenditure, (including establishment).
	Rs. A. P.	Rs. A. P.
Sibpur	2,888 0 10	9,210 2 1
Dacca	2,408 8 9	1,422 2 3

The work done at the Sibpur seed-store is not satisfactory. It has therefore been abolished and accommodation has been found for the present in a room in the buildings of the Presidency Jail. It is in contemplation, however, to abolish this seed store altogether and meet the requirements of the public from the farms direct.

CHAPTER VI.

MISCELLANEOUS.

32. **Arboriculture.**—Mr. Proudlock worked as in previous years in connection with the improvement of the new civil station of Dacca, and occupied himself chiefly in keeping in order and partly laying out the

Government House compound, and in laying out, planting, otherwise improving and keeping in order several residential compounds and the compounds of certain public buildings, such as the Dacca College, the Dacca Secretariat, the Ramna Charitable Dispensary, etc. Several changes were also made in the garden attached to the temporary Government House, and beds and borders planted with flower seeds imported from England. The work of weeding and laying out part of the new Government House compound was in progress, when it was stopped. pending decision of the question as to whether the building was to be made over to the University Committee. The plant-house in the nursery was extended. Flower seeds were imported from England. The general appearance of the grounds of the new civil station of Dacca was improved during the period under report. Mr. Proudlock also wrote a very useful note in connection with the proposed revision of the Arboricultural Manual.

33. **Rangpur Dairy Farm.**—This farm has been started with the primary object of making some contribution to the problem of improving the existing cattle, native to Bengal, by a process of selection and elimination. It is also proposed to show, if possible, that mixed farming on a considerable scale can be run at a profit. Mr. J. N. Chakravarti, Agricultural Supervisor, has been placed in charge of the farm.

A piece of land measuring about 334 acres, consisting of about 250 acres of high land, 67 acres of low land fit for winter paddy and 17 acres of beel land, has been selected at Rangpur. This place was chosen partly because the price of milk is very high there, and partly because there are already two other farms at Rangpur which can work in conjunction with the dairy farm. Another important point is that the farm is close to the railway station and well supplied with water. Formal possession of the waste and arable portion of the land was obtained only at the end of March last, so the work during the last three months of the year under review was one of preparation only by fencing the boundary, planting a live hedge along the border and building the quarters for the overseer and the Superintendent. The Department is likely to be in possession of all the land by the beginning of November, when it will be possible to take up the work of the farm as a whole, and push it vigorously. It is proposed to carry out the following cropping scheme for the coming *rabi* season :—

	Bighas.
Potato	100
Tobacco	50
Vegetables	5
Fodder crops (oats, peas and *matikalai*)	150

Six 50-bigha blocks will also be planted with *dub* grass for pasture.

On the 30th June the cattle consisted of one bull, 29 cows and 23 calves. The cows were obtained from Dacca, Saidpur, Calcutta, Berhampur and Malda. Ten pairs of plough-bullocks have also been purchased. It is proposed to provide accommodation ultimately for 150 to 200 cows on the farm. The cows when tested before purchase gave more than 4 seers of milk a day. None of them have, however, been able to maintain the standard after arrival at the farm. Under the present conditions it is not possible to ascertain the exact milk-yielding capacity of each cow, as the calves are allowed to suck for nearly six hours every day. As soon, however, as calves are born on the farm, it is proposed to introduce the system of hand-feeding. The exact milking capacity of each cow will then be ascertained. Plenty of grazing is being given to the cows, and a milk record is being kept of each cow separately. The improvement in cattle which the farm is seeking to make will be the effect as much of judicious breeding and selection as of careful and liberal feeding. Suitable fodder crops will be grown on the farm, and in the course of a few years it is expected to breed a race of cows giving a good yield of milk at moderate cost, and a race of draught-cattle which will be suitable for ploughing. The best cows will be kept for the farm and the bulls will be distributed to suitable centres for breeding purposes. The total expenditure incurred for the farm from April to June amounted to

Rs. 7,638-3-7, and receipts from sale of milk, etc., during the period were Rs. 729-13-6.

34. **Weaving operations.**—Mr. N. N. Pillay, the Weaving Master, visited during the year under report almost all the weaving centres in the districts of Mymensingh, Pabna, Rangpur, Rajshahi, Malda and Murshidabad. He also visited certain places in Assam on special deputation. His principal work consisted in demonstrating the fly-shuttle and Salvation Army loom, and an improved warping apparatus as well as an improved form of silk-reeling machine and in instructing the people in improved methods of weaving. In Mymensingh he reorganized a weaving class attached to the Kasi Kisore Technical School, which was subsequently transferred to Tangail. The Weaving Master also visited the Government Weaving Institute at Serampore as well as the Pusa College to obtain suggestions regarding any improved appliances on methods of reeling that might be worth introducing among the people.

35. **Rainfall stations.**—During the year there were 225 rainfall recording stations in Bengal. No new station was started.

The statement below gives the number of rainfall-stations in each district and the number inspected during the year :—

Names of Districts.	Number of rain-gauge stations.	Number of rain-gauge stations inspected.	Names of Districts.	Number of rain-gauge stations.	Number of rain-gauge stations inspected.
24-Parganas ...	9	...	Rangpur ...	9	6
Nadia	6	1	Bogra	4	1
Murshidabad ...	10	3	Pabna	4	1
Jessore	5	...	Malda	6	6
Khulna ...	12	8	Dacca	8	2
Burdwan ...	8	1	Mymensingh ...	11	7
Birbhum ...	6	...	Faridpur ...	10	3
Bankura ...	10	6	Bakarganj ...	8	2
Midnapore ...	27	...	Chittagong ...	7	1
Hooghly ...	3	...	Tippera ...	8	1
Howrah ...	4	...	Noakhali ...	7	1
Rajshahi ...	7	...	Chittagong Hill Tracts.	3	1
Dinajpur ...	13	4			
Jalpaiguri ...	8	1	Cooch Behar ...	5	3
Darjeeling ...	6	...	Hill Tippera ...	1	...

36. **Agricultural implements.**—A list of the agricultural implements and machines reported to have been tested in the province during the year under review is given in Appendix III.

APPENDIX I.

Agricultural Stations, 1912-13.

Dacca.—Experimental work at this farm during the year under report was continued on the same lines as in preceding years, and as a result of the year's work, another crop—sugarcane—has been added to the other two economical ones grown on this laterite area, viz., summer rice and winter rice. In fact, a splendid crop of sugarcane was grown at the Dacca Farm in 1912 without irrigation. From 5½ acres of newly planted thick canes an average outturn per acre of 61⅘ maunds of *gur* was obtained, while 5½ acres of ratooned thick canes gave an average outturn of 40⅔ maunds per acre. These results are phenomenal for the laterite soil of the Madhupur jungle. Whether this was due only to the excessive rainfall of 1912 remains to be seen. As a result of the work at this season the following varieties of crops and manures can be recommended for this laterite area:—

A.—Winter rice *(Aman dhan)*—

(a) Varieties—
(1) *Malaty* (white medium grain).
(2) *Lahadang* (very coarse red).
(3) *Lalbalam* (red).
(4) *Kataribhog* (very fine white).
(5) *Badshabhog* (ditto).
(6) *Dadkhani* (ditto).

(b) Manures—
(1) Bonemeal three maunds per acre.
(2) *Dhaincha* green manure.
(3) Fish-manure.

B.—Summer rice *(Aus dhan)*—

Varieties—
(1) *Larcose* (fine).
(2) *Surjukukhi* (fine).
(3) *Gorfa* (coarse).

C.—Sugarcane.—

(a) Varieties—
(1) *Barbadoes* No. 147B.
(2) *Striped Tana.*
(3) *Yellow Tana.*
(4) *Barbadoes* No. 208B.
(5) *Dacca Gandheri.*

(b) Manures—
300 maunds cowdung per acre.
20 maunds castor-cake per acre.

This station serves as a store for seeds, manures and implements for the two divisions of Dacca and Chittagong.

Eight apprentices received training during the year and they have all been taken for demonstration work in the districts.

Apart from the expenditure in connection with the laboratories and Botanical section the farm expenditure for April-March was Rs. 27,688-9-10, while receipts were only Rs. 11,653-7-3. Of this expenditure Rs. 6,500-14-4 were for establishment.

Chinsurah.—This farm is typical of Lower Bengal and is particularly suited to winter rice and jute. Sugarcane can be grown, but the heaviness of the soil makes cultivation very difficult and costly. The work on this farm then will be restricted to these two crops in future, and in addition to experimental work on each crop, a large supply of seed will be produced for distribution purposes.

The year under report was favourable to winter rice and jute, and excellent crops of each were grown on sufficiently large areas to excite the admiration of many of the neighbouring raiyats who came to inspect the crops several times.

Financially the farm did very well. During the year April-March 1912-13, the receipts were Rs. 10,117-15-9, while expenditure, including cattle

food, establishment and ordinary farm expenditure, was only Rs. 9,272-2-3 To the Farm Superintendent, Babu Tara Nath Roy, is due all credit for this result. Such a result has never been obtained before on a Government farm in Bengal.

So far as experimental work is concerned, we are still dealing with ununiform conditions, but as a result of the work at this farm, we can recommend *nagra* paddy as a medium grained variety and *dadkhani* paddy as a fine grained variety of winter rice, while we can recommend Hooghly *deshi* jute (an *olitorius* variety) and Java or Mauritius canes to the cultivators of the district.

This station has a seed-store for seeds, manures and implements for the Burdwan Division, but owing to the apathy of the public, the Superintendent has little work in this respect. A well will shortly be constructed at this farm which will be a great blessing.

Rajshahi.—The farm acts as a centre of distribution for seeds, manures and implements, but little work in this respect has to be done owing to the indifference of the people of the district. What seeds were distributed from this farm were sent to other parts of the province.

The work at this farm has hitherto been confined to sugarcane, jute, *sunn* hemp, *aman* and *aus* paddy, potatoes and *rabi* crops. In 1913-14, the chief work will be on jute seed production for seed supply and on sugarcane and potatoes. During the year seeds of the above crops were distributed, and the farm can act as a depôt for seeds, manures and implements for the district when local people become interested.

The striking result of our work at this farm in 1912-13 was the overwhelming nature of the climatic factor. Owing to a partial drought in September-October, the outturn of *aman* paddy was lowered to six maunds per acre as compared with 24¼ maunds in 1911. This is a much greater difference than that caused by any or all other factors, such as manure variety and methods of cultivation, put together. Striking results have also been obtained with sugarcane, *aus* paddy and potatoes.

Sugarcane and potatoes suit this soil and district, and both the crops can be economically grown on such soils in this district without irrigation and on 150 maunds of cowdung per acre.

The Rangpur *vendamukhi* cane and the Hooghly *shamshara* variety give an increased outturn of 20 maunds of *gur* per acre over the local variety, which is deservedly popular on account of its cheap cost of cultivation.

Darjeeling and Italian potatoes, both waxy varieties, are suited to this soil and district and may be profitably employed. A very important point to observe is the larger outturn of tubers that is obtained by employing large sets at planting time.

The local variety of *aus* paddy—*morisboty*—is the best variety for this soil and district, and should be improved by selection at harvest time. This corroborates all our work hitherto on varieties of paddy, viz., that the most popular variety of paddy in any district is the most economical for that district.

During the year April-March 1912-13, the receipts were Rs. 3,395-12-9, while the expenditure amounted to Rs. 10,232-1.

A *pucca* cattle-shed and a threshing-floor are now being built at this farm.

Burirhat.—This station reserved purely for tobacco questions has done excellent work during the few years of its existence. In fact, to say the least, the results have been phenomenal. The ordinary tobacco cultivator in the district grows a crop of 10 to 15 maunds per acre, which he sells at about Rs. 15 per maund. Best quality—*barapat* is sold at Rs. 20 and poor quality—*bispat*—at Rs. 8 to 10 per maund; whereas 15 to 20 maunds of tobacco leaf per acre have been grown in this farm which obtained the following prices:—in 1910, Rs. 40 per maund; in 1911, Rs. 90 per maund; in 1912, Rs. 65 per maund. These high prices were obtained for a cigar leaf wrapper, which is sold to cigar manufacturers of Madras and Trichinopoly, who are actually prepared to deal with us if we can guarantee a sufficiently large quantity of uniform quality. Now, in preparing a good quality of cigar leaf wrapper, great care has to be taken in harvesting and drying the leaf, as well as in handling each leaf gently, shaking off the sand, hanging up each leaf separately in a shed and turning repeatedly; the tobacco has also to be fermented, which requires a shed and several months' time. Taking these things into consideration, besides the heavy freight that has to be paid in selling the tobacco in such distant places as Madras or Trichinopoly, it is doubtful whether growing tobacco leaf

wrapper in Rangpur is of any practical utility to the cultivator till there is more local enterprise, and as there are no cigar factories in Bengal, it will probably be best to restrict our work in future to those classes of tobacco which are sold locally in enormous quantities. Credit is, however, due to Babu Jamini Kumar Biswas, Superintendent of this farm, who has proved that a good class cigar tobacco can be grown and cured in Rangpur.

American tobacco has been grown and flue-cured at this farm for cigarette manufacture, which obtained the following prices:—in 1911, 25 maunds at Rs. 30 per maund; in 1912, 11 maunds at Rs. 26-4 per maund.

Turkish tobacco has also been grown at this farm and shade-cured and flue-cured, obtaining the following prices:—in 1911, 47 seers at Rs. 65 per maund; in 1912, 11 seers at Rs. 70 per maund.

The Sumatra crop of 1911-12 has been sold, but the prices realized were not so good as were expected. The 1912-13 tobacco crop is now in process of fermentation, and should be ready for the market in September-October. A much larger crop has been grown this year, and when the present crop of 110 maunds of tobacco leaf has been sold, the prices obtained will make interesting reading.

The total receipts and expenditures during the year April-March 1912-13 were Rs. 900-13-4 and Rs. 9,868-3-3 respectively.

Rangpur.—This small farm of 20 acres has had a very chequered career during the eight years of its existence. Heavy expenditure has been incurred in the past, which will now be remedied.

The land is typical of the Rangpur district and is essentially suited to paddy, jute and sugarcane. The farm has also a seed-store for the district, but very little work is done in this section.

During the year under report the dreaded potato disease, Phytophthora Infestans, made its appearance, and practically wiped out the whole of the potato crop in the district. The attack was sudden and the damage was done before any remedial measures could be undertaken.

As a result of the work at this station, the following recommendations can be made:—

(1) *Hewti* jute (*Corchorus capsularis*) is an excellent variety for this district. It is a heavy yielder and produces first quality fibre.
(2) *Badshabhog* paddy—a very fine variety—is suited to this soil and district.
(3) Sugarcane *Gandheri*, white *Tana*, striped *Tana* and striped Mauritius varieties are all suited to this district. One hundred maunds of *gur* per acre may be expected without irrigation from a manurial application of 15 maunds of cowdung and 15 maunds of rape cake per acre.
(4) Darjeeling potatoes are suited to this district. Over 200 maunds per acre may be expected from an application of 300 maunds cowdung per acre.
(5) Large tubers (potatoes) should be employed by the cultivator (at planting time).
(6) *Juar* as a *kharif* crop and oats and peas as a *rabi* crop are splendid fodder crops, if the raiyat wants more fodder crops.
(7) The Meston plough and the Planet hand-hoe are suited for the light friable soils of Rangpur.

(During the year April-March 1912-13, the receipts were Rs. 1,564-0-3 and expenditure was Rs. 3,287.)

Burdwan.—This small farm of 32 acres, which belongs to the Maharajadhiraj of Burdwan, who pays all expenses, is now a demonstration farm. The land is very poor. Half would go out of cultivation immediately if we left it, and only an early *aman* paddy would be grown on the remainder.

The receipts and expenditure for 1912-13 were Rs. 2,065-5-6 and Rs. 3,395-5-6 respectively against Rs. 1,753-10-10 receipts and Rs. 4,326-8-11 expenditure for the previous year. Babu J. C. Dey, Superintendent of the Farm, worked well and deserves every credit for the results that have been obtained.

Kalimpong.—From the report of Mr. J. Wilson who is in charge of this demonstration farm, it appears that the good work of the previous years was continued during the last year. An outturn of 41½ maunds of maize per acre was obtained from 1 acre of white flat maize, while the average outturn of maize from 17½ acres was 33¼ maunds per acre. This compares very favourably with the average outturns in previous years, viz.:—1909, 21½ maunds, 1910, 27½ maunds and 1911, 30¼ maunds.

Maize is the most important crop for a locality of the elevation, position, aspect and soil represented by this farm, and that it is more economical than rice which is the only other important crop on this hillside will be gathered from the fact that maize yields an average outturn of 33 maunds at a cost of Rs. 45, while rice yields only 16 maunds of grain *plus* straw at a cost of Rs. 44 per acre (both crops being priced locally at Rs. 3 per maund); besides, the former which is harvested in September allows of an excellent crop of *kodo* (24 maunds per acre at Rs. 3-2 per acre being obtained from the same land in the same year), but paddy which is not harvested till November-December will not allow of a second crop. Sugarcane takes 18 months to be mature and is then stunted in growth. *Aus* paddy runs to straw which grows 7 feet long and produces 160 maunds per acre! Leguminous crops such as *mung*, soybeans, *guaians* and *mashyem* following maize depend entirely on the luxuriance of that crop, *e.g.*, if the maize crop is luxurious, the secondary crops are poor and *vice versâ*. As the secondary crop is good with 10 to 12 maunds per acre and poor with 6 maunds, the value is small compared with 10 maunds of maize. Both *kodo* with an outturn of 24 maunds of grain per acre and buckwheat 10 maunds per acre (Rs. 3-2 per maund and cost Rs. 17) are economical for this hillside, especially as they follow maize on the same land in the same year. *Jaunpur* maize is not suited for hillside and *juar* which grows well here is not popular in the district.

Terracing is probably not necessary where the slope is gentle, and it appears to be only economical and necessary where the slope is very steep to prevent excessive scouring.

From the experiments, manuring has had little effect on this soil doubtless on account of its richness, although the heavy average outturn of maize must be due to the application of farmyard manure.

Oranges thrive well on the farm. Pineapples are also very successful, but apple, apricot nectarine, pear, peach, etc., have failed after five years' experiment.

It is evident from the above that a cultivator with 5 acres (supposing rent to be Re. 1 per acre), who grows maize on 3 acres, rice 2 acres, *kodo* 1 acre, buckwheat and soybean on 1 acre each, can expect a monetary return of about Rs. 600 per annum.

In conclusion, it may be said that with receipts of Rs. 3,311-9-9, ordinary farm expenditure of Rs. 2,630-1-8 and capital outlay of Rs. 507-12 for a *machan* for storing maize, this farm is well managed.

Model Farm at Chittagong.—This farm was originally started with an area of 48 acres of land, of which 8 acres only covered by 3 small but continuous hills have been reserved in possession of Government, the rest being temporarily leased out for a term of five years on condition that the lessee must grow such crop as the Director of Agriculture shall direct for the purpose of demonstration on at least 6 acres of land.

The total cost incurred during the year under report in the upkeep of the garden, maintenance of three farm bullocks and cultivation of soybean, is Rs. 213, and total receipt from sale of garden products is Rs. 172-10-3 as against Rs. 346-12-6 expenditure and Rs. 109-1-6 receipt of the previous year.

Maulvi Amjad Ali, retired Sub-Deputy Collector, is the lessee of the leased out portion of the farm. He has not carried out demonstration as instructed by the Director of Agriculture, and he has taken no care for the maintenance of the roads, bridges, threshing-floor and store and out-houses which were constructed at Government expense. The term of his lease will expire on the 31st December 1913, and the question about the disposal of the area after the expiry of the lease is still under consideration. If the contemplated scheme of cattle-breeding in Chittagong is ever taken up, the entire area of the farm will be required for the purpose.

APPENDIX II.

Agricultural Shows and Fairs.

rial No.	NAME OF FAIR AND LOCALITY.	Dates on which the exhibition was held.	Amount contributed by the Agricultural Department.	Officers of the Department who attended or helped in the Agricultural show.	Exhibits sent and demonstration given by the Department.
1	2	3	4	5	6
			Rs.		
1	Agricultural and Industrial Exhibition, Malda.	16th to 22nd February 1913.	500	Director of Agriculture, Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations in ploughing, pumping, *gur*-making. Also lectures.
2	Agricultural and Industrial Exhibition, Midnapore.	17th to 23rd February 1913.	200	Deputy Director of Agriculture and Divisional Agricultural Inspector, Burdwan Division.	Departmental exhibits; demonstrations in ploughing, pumping, and in the use of chaff-cutting maize-huller, Planet Junior hand hoe. Also lecture on crops and their cultivation.
3	Agricultural and Industrial Exhibition, Meherpur (Nadia).	2nd to 7th March 1913.	200	Deputy Director of Agriculture and Divisional Agricultural Inspector, Presidency Division.	Departmental exhibits.
4	Agricultural and Industrial Exhibition, Ranaghat (Nadia).	24th February to 2nd March 1913.	200	Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations in ploughing, chaff-cutting, pumping and *gur*-making.
5	Kalimpong *Mela* (Darjeeling).	20th and 21st November 1912.	500	Ditto ditto ...	Departmental exhibits; demonstrations in the use of maize-huller, chaff-cutter and ploughing.
6	Faridpur Agricultural Exhibition, Faridpur.	11th to 31st January 1913.	100	Deputy Director of Agriculture, Agricultural Supervisor and a Demonstrator.	Departmental exhibits; demonstration in ploughing.
7	Agricultural Show, Janajat (Faridpur).	13th and 14th January 1913.	Nil	Deputy Director of Agriculture and a Demonstrator.	Ditto ditto.
8	Suri Cattle and Produce Show, Suri (Birbhum).	8th to 10th February 1913.	300	Deputy Director of Agriculture and Divisional Agricultural Inspector.	Departmental exhibits; demonstrations in *gur*-making, chaff-cutting, irrigation, ploughing. Also lectures and magic-lantern show.
9	Khulna Coronation Exhibition, Khulna.	3rd to 12th February 1913.	500	Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations in ploughing, irrigation, and the use of chaff-cutter. Also lectures.
10	Agricultural and Industrial Exhibition, Jessore.	26th to 28th February 1913.	100	Deputy Director of Agriculture and Divisional Agricultural Inspector, Presidency Division.	Departmental exhibits; demonstrations in ploughing, pumping, chaff-cutting, manufacture of *gur* with three-roller sugar-cane mill. Also lectures on crop cultivation.
11	Agricultural and Industrial Exhibition, Narail (Jessore)	21st to 23rd February 1913.	100	Ditto ditto ...	Ditto ditto.
12	Agricultural and Industrial Exhibition, Magura (Jessore).	17th to 19th February 1913.	100	Ditto ditto ...	Ditto ditto.
13	Agricultural and Industrial Exhibition, Jhenidah (Jessore).	13th to 15th February 1913.	100	Ditto ditto ...	Ditto ditto.
14	Agricultural and Industrial Exhibition, Bongaon (Jessore).	8th to 10th February 1913.	100	Ditto ditto ...	Departmental exhibits; demonstrations in ploughing, irrigation, *gur*-making. Also lectures.

APPENDIX II—*concluded.*

Serial No.	NAME OF FAIR AND LOCALITY.	Dates on which the exhibition was held.	Amount contributed by the Agricultural Department.	Officers of the Department who attended or helped in the Agricultural show.	Exhibits sent and demonstration given by the Department.
1	2	3	4	5	6
			Rs.		
15	Industrial and Agricultural Exhibition, Barasat (24-Parganas).	11th to 13th February 1913.	200	Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations in ploughing, irrigation, *gur*-making. Also lectures.
16	Industrial and Agricultural Exhibition, Tangail (Mymensingh).	27th January to 14th February 1913.	Nil	Director of Agriculture, Deputy Director of Agriculture, District Agricultural Officer, Mymensingh, and a Demonstrator.	A few exhibits of seeds, manures and implements; demonstrations in ploughing and winnowing.
17	Industrial and Agricultural Exhibition, Banjetia (Murshidabad).	28th February to 3rd March 1913.	300	Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations with Meston plough, chain pump, iron stone, chaff-cutter, and Planet Junior hand hoe Also lectures.
18	Agricultural and Industrial Exhibition, Chinsurah (Hooghly).	21st to 28th February 1913.	300	Deputy Director of Agriculture and Agricultural Inspector, Burdwan Division.	Departmental exhibits; demonstrations in ploughing, pumping, chaff-cutting, *gur*-making, and also in the working of maize-huller and Planet Junior hand hoe. Also magic-lantern show.
19	Industrial and Agricultural Exhibition, Kurigram (Rangpur).	1st to 10th March 1913.	100	Director of Agriculture and Agricultural Supervisor.	Departmental exhibits.
20	Flower, Vegetable and Fruit Show, Kurseong (Darjeeling).	7th April 1913 ...	100	Deputy Director of Agriculture	Ditto.
21	Panchthupi Kesherpahor Agricultural Exhibition, Kandi subdivision (Murshidabad).	21st to 27th February 1913.	100	Nil ...	Nil.
22	Alwakhawa Rash *Mela*, subdivision Thakurgaon, district Dinajpur.	During Rash Purnima, and lasts over a fortnight.	Nil	Nil ...	Nil.

APPENDIX III.

A list of Agricultural implements and machines tested in Bengal during the year ending 30th June 1913 and of those in use which are reported to have met with success.

No.	Designation of implements.	Use.	Special advantage.	Price.	Where procurable.	Name and designation of reporting officers.	Opinion.	Extent to which used by cultivators.
1	2	3	4	5	6	7	8	9
				Rs. A.				
1	"Behia" sugar-cane-crushing mill.	Crushing sugar-cane.	Juice can be extracted in a short time with less labour and expense.	90 0	Messrs. Thomson and Mylne, Behia, Shahabad.	Babu Woopendra Ch. Dutta, General Manager, Wards' Estates, Chittagong, and Subdivisional Officer, Narail.	An efficient machine for extracting juice from sugarcane.	Its use is invariably preferred by those who have appreciated the utility of the machine.
2	Iron Dons ...	Lifting water for irrigation.	The cheapest and best apparatus for raising water from small depths in tanks and rivers.	7 8	Suri, Rampur Hât and Ghuskara.	Honorary Secretary, Bankura District Agricultural Association.	Very useful and economical.	Use is being gradually extended.
3	Maize-huller ...	Separating seeds from cobs.	Saves good deal of manual labour.	2 12	Director of Agriculture, Bengal.	Lala Mrityunjoy Lal, Secretary, District Agricultural Association, Birbhum.	Its use not appreciated by cultivators.	Not used by the cultivators.
4	Seed-drill	For sowing seeds.	Ditto ...	15 5	Ditto ...	Ditto ...	Ditto ...	Ditto.
5	8' Chain pump ...	For lifting water from wells.	Ditto ...	53 1	Messrs. Burn & Co., Howrah.	Ditto ...	Ditto ...	Ditto.
6	"Junior" hand hoe.	Hoeing and weeding plants.	Very useful in making ridges.	15 8 to 40 11	Department of Agriculture, Bengal, and T. E. Thomson & Co., Calcutta.	Babu Monmohan Gupta, Deputy Magistrate, Malda, and Mr. J. N. Chakraburtty, Agricultural Supervisor, Bengal.	Very useful, and advantageous specially in case of mulberry and potato fields.	To a limited extent on account of its high price.
7	Meston plough ...	Ploughing lands ...	More effective than country plough. It makes deeper furrows and slight inversion of soil.	5 0	Department of Agriculture, Bengal, T. E. Thomson & Co., Calcutta, and also Messrs. Burn & Co.	Ditto ...	Very useful; works satisfactorily on light soil.	Used on a moderate scale, but its use is being extended.
8	Burn's hand cultivator.	Interculture between potato, tobacco and sugarcane lines.	Works quick and economical.	12 8	Messrs. Burn & Co., Calcutta.	Mr. J. N. Chakraburtty, Agricultural Supervisor, Bengal.	Useful	Coming into use.
9	Winnowing machine	For winnowing paddy, oats, etc.	Works cleaner and economical.	141 12	Messrs. T. E. Thomson & Co.	Ditto ...	Requires further testing.	Not used by cultivators.
10	Shallow pan for making *gur*.	Manufacturing sugar.	A large quantity of juice can be boiled at one time with less labour and expense.	30 0 to 60 0	Department of Agriculture, Bengal, and Messrs. Thomson and Mylne, Behia.	Manager, Burdwan Raj.	Very useful and appreciated by cultivators.	Used largely by cultivators.
11	Hindusthan plough	Ploughing lands ...	More effective than country plough.	10 8 to 13 8	Messrs. Leslie & Co., Calcutta, and the Department of Agriculture, Bengal.	Manager, Burdwan Raj, Honorary Secretary, District Agricultural Association, Bankura.	Works very satisfactorily, but too heavy for country bullocks to pull them.	Used to a small extent, but appreciated by cultivators.
12	Shibpur plough ...	Ditto ...	Makes a deep cultivation.	11 0	Government Seed Store, Shibpur.	Babu Jatindra Nath Bose, Member, District Agricultural Association, Alipur.	Satisfactory	Two such ploughs are being used by different agriculturists.
13	Hand spray ...	For hand spraying small fields and plants.	An effective contrivance.	2 0	Ditto ...	Babu Satendra Nath Ghose, Member, District Agricultural Association, Alipur.	For extensive gardening.	Not used by cultivators.

B. S Press—5-12-1913—2261J—580—T. W. L.

REVENUE DEPARTMENT.

AGRICULTURE.

CALCUTTA, THE 19TH JANUARY 1914.

RESOLUTION—No. 615.

READ—

The Report of the Department of Agriculture, Bengal, for the year ending the 30th June 1913.

Staff.—Mr. J. R. Blackwood was in charge of the Department throughout the year. Mr. A. A. Meggitt as Agricultural Chemist worked both for this province and for Assam. Mr. G. P. Hector held the post of Economic Botanist and Mr. F. Smith that of Deputy Director of Agriculture. A serious check to the work of the Department was caused by the departure on leave, owing to ill-health, of Mr. Finlow, the Fibre Expert. The Government of India were unable to supply any officer of the Imperial Department of Agriculture to take his place, and his work has been carried on, so far as possible, by Messrs. Meggitt and Hector in addition to their other duties.

Another year's experience has convinced the Governor in Council that the superior staff of the Department is inadequate to deal satisfactorily with the task of improving the agricultural conditions of this Presidency. The Government of India have already sanctioned the creation of a separate post of Agricultural Chemist for Bengal, and an application has been made for the services of a second Deputy Director of Agriculture. In the event of this appointment being sanctioned, it will be possible to make a considerable advance in the control and organization of agricultural work in the province, and in the dissemination of the results already achieved among the cultivating classes.

A scheme for the co-ordination of the subordinate establishment of the Agricultural service in the Eastern and Western parts of the province and for the constitution of regular Provincial and Subordinate Agricultural services is also under the consideration of Government. Meanwhile two new agricultural supervisors have been appointed on probation. Both of them are graduates in Agriculture—one of the University of Edinburgh and the other of the University of Cornell in the United States of America.

2. *Agricultural Education.*—There is no agricultural college in this Presidency, and it is reported that the number of students from this province in the College at Sabour in Bihar and Orissa is diminishing in spite of the facilities offered to them, mainly owing to the lack of definite prospects of employment open to persons who have undergone a course of higher agricultural training. This difficulty will to some extent diminish as the official Department of Agriculture expands, but it is regrettable that the opportunities now available for training in agriculture should be so little appreciated by the landholding and cultivating classes. In view of the scanty support extended to the Sabour College, the Governor in Council has for the present definitely abandoned the proposal that an agricultural college should be established in connection with the Dacca University, but the Director of Agriculture has been requested to consider, in consultation with the Director of Public Instruction, whether it would be possible to provide on the Dacca farm a short elementary course in practical agriculture for the sons of gentlemen. Meanwhile practical instruction is being given on all the farms, so far as possible, to apprentices who are subsequently appointed as fieldmen demonstrators.

The reports as to the scheme for nature study in primary schools are disappointing. Most of the schools are said to be still without a suitable garden, but some progress has been made in Jessore and Khulna, and it is hoped that the question will not be lost sight of by the Education Department, to whom the Director of Agriculture should render all the assistance in his power.

3. *Research and experiments at agricultural stations.*—The Governor in Council is glad to see that a fuller account has been given than in last year's report of the work done by the scientific officers of the Department. No new agricultural stations were opened during the year. At the six existing stations, the investigations previously in progress were continued, and in some cases definite results were obtained or indicated. The experiments made by the Fibre Expert in regard to the manurial requirements of jute suggest that by the use of bonemeal and lime, jute and mustard crops can be profitably grown on the same land in one year. Mr Finlow's work on the classification of jute races has been continued; and though it is perhaps too early to expect definite results, the Governor in Council would have been glad to have a fuller account of the progress of the work. Mr. Meggitt's work on sugarcane has so far been very successful, and as a result of the soil treatment adopted, the outturn of cane has risen during the last five years from 10 to 30 tons per acre. The use of lime and bonemeal has had a remarkable effect on the fertility of the soil of the Dacca farm, particularly in the case of *rabi* crops, and it is hoped that the experiments, which will be continued for the full period of six years as originally contemplated, will yield definite results in regard to the residual value of manuring over a number of years. Green manuring experiments have also been continued, and so far the cowpea has proved itself the most useful plant for this purpose. Mr. Hector's important botanical work in connection with the rice crop has shown that natural cross-fertilization takes place to a much greater extent than was at first supposed, and a few successful crosses have been obtained. Special attention is rightly being paid to the higher yielding varieties. A large amount of time has been devoted to the study of the *ufra* disease of paddy, which has appeared on a considerable scale in some of the deltaic districts of Eastern Bengal, and a full account of the work up to date is being published. It has been established that the disease is caused by an eelworm of the genus *Tylenchus*, allied to worms which cause well-known diseases of other cereals. The best remedy, so far discovered, appears to be the destruction of the worm, when in a passive condition after harvest, by burning the stubble. An attempt is being made to work out a feasible scheme for dealing with the evil, but the problem which is of the utmost importance to the welfare of the province is one of much difficulty. An excellent account is given in Appendix I of the Report of the work done in the minor agricultural stations in the Province, but indications are not wanting that the work requires to be systematised. This can best be secured by the personal supervision of the Director, who should, in close communication with his expert advisers, lay down the lines upon which work is to proceed in each farm and see that his orders are steadily and intelligently obeyed.

4. *Sericulture.*—The Silk Committee, consisting of the representatives of the principal silk firms in Bengal with the Director of Agriculture as President, continued to be in charge of silk operations in the Presidency. M. Lafont, the French Expert in Hybridisation, who was appointed for a term of three years, was unfortunately compelled to leave India on account of ill health at the end of January 1913 after having been little more than a year in the country. Another expert, M. Grangeon, who has had experience of silk work at Madagascar, has been appointed to succeed him and has recently taken up his duties. The scheme for the supply of pure seed, which was referred to in the resolution on last year's report, was considered at a special meeting of the Bengal Silk Committee held under the presidency of the Hon'ble Mr. P. C. Lyon, C.S.I., and it was decided to accept it as the basis of future work for the assistance of the silk industry in this province. The object is to establish gradually throughout the silk districts a sufficient number of central nurseries with rearing houses built in groups, from which pure seed cocoons will be supplied under Government supervision. In pursuance of this scheme, a number of the existing smaller nurseries were closed during the year, and steps have been taken to convert others of the smaller nurseries into enlarged and improved central nurseries with rearing houses complete. In the Malda district, land was acquired during the year for a new central nursery at Piasbari, and the establishment

of another new nursery at Amriti in the same district is under consideration. The ultimate success of the scheme depends largely on the willingness of the cultivators to pay an adequate price for pure seed.

5. *Tobacco.*—The appendix to the report shows that remarkable results have been achieved at the Burirhat Farm in Rangpur in the growth of good class cigar tobacco, and that high prices have been obtained from cigar manufacturers in Madras and Trichinopoly. As, however, there is no local market for such tobacco, it is doubtful whether much practical benefit has resulted to the ordinary cultivators; and unless a connection can be established between them and the manufacturers in Southern India, it would seem advisable to restrict future operations mainly to the local varieties of tobacco, on which also useful work appears to have been done.

6. *The Rangpur Dairy Farm*—An area of about 334 acres has been acquired at Rangpur with the object of establishing a mixed farm and throwing some light on the difficult problems connected with the breeding and maintenance of cattle in a highly cultivated tract. The increasing encroachment of cultivation on the pasture lands of the villages in the greater part of the province has attracted much attention recently, and the only feasible remedy from an economic point of view, which has so far been suggested, is the adoption of some form of mixed farming. In order to introduce this new departure, it will be necessary to show the ordinary cultivator that successful agriculture depends upon attention being paid to his stock as well as to his crops. Possession of the farm lands at Rangpur was not obtained until the end of March, and only preliminary work could be carried out during the year, but the scheme will now be pushed on. If success is to be achieved, and definite results obtained, it will be necessary for the Director to pay the minutest attention to detail, and to avail himself of the best advice which he can procure both from agricultural and from veterinary experts.

7. *Demonstration work.*—A scheme for organising and improving the demonstration work of the Department is now under the consideration of Government. It is hoped eventually to have a demonstrator in every thana, working under the supervision of trained officers in each district. It will be some time before the scheme can be fully worked up to, as it will be necessary to train men for the work. An increase to the existing staff was sanctioned during the year, and there is now approximately one Government demonstrator in every subdivision in Eastern Bengal. Demonstrations in the use of bonemeal manure have aroused considerable interest in several districts, and it is reported that a number of zamindars are advancing money for the supply of bonemeal to their raiyats, on the understanding that the manure is to be used under the supervision of the Department. It is understood that accurate records of the results secured by the demonstrators are being maintained, and the Governor in Council hopes that full information on this point will be given in next year's report. Demonstrations of the cultivation of improved types of potatoes have also proved successful in some districts, and a beginning has been made with the introduction of improved methods of conserving cowdung manure. It is stated that a considerable amount of work has been done by the Government demonstrators in marking down the best stalks of jute and paddy for seed. There is undoubtedly a wide field for useful effort in this direction, as the process of seed selection is at present little understood by the ordinary cultivator, who is apt to use any seed indiscriminately and is naturally averse to reserving his best stalks for seed. At the same time, the work of seed selection must be carefully and intelligently done, if it is to be of any practical use. His Excellency in Council trusts therefore that it is being adequately supervised by competent persons, and that a full record is being maintained of the results achieved.

In Western Bengal, the work of demonstration is mainly in the hands of members of the Divisional and District Associations. Some of these gentlemen have achieved useful results, but there have also been many failures, some of which might apparently have been avoided if the Department had been in a position to afford a greater measure of advice and assistance. The task of supervising the whole of the demonstration work of the province is, however, too much for one Deputy Director, and cannot be

fully overtaken until the appointment of a second Deputy Director with an adequate establishment is sanctioned. Meanwhile the Governor in Council trusts that the Director will do his best with the staff at his disposal to render all possible assistance and advice to those gentlemen, who have shown themselves willing to undertake practical work. Nothing can be more discouraging to the improvement of agricultural methods than to find the results of serious effort inconclusive or unsuccessful, and willing workers should not be allowed to divert their energies into unprofitable or unpractical channels. More use might be made of agricultural shows and fairs in this connection. Such gatherings are very popular in many places, and the opportunities thus afforded to the officers of the Agricultural Department should be fully utilised to get into touch with the cultivators and to disseminate useful and practical information amongst them. The mere exhibition of implements, seeds and manures and the delivery of lectures will have little effect unless they are followed by serious attempts to maintain touch with the cultivators who show themselves ready to undertake practical work in their fields. As soon as definite results have been obtained regarding seed selection, the use of bonemeal manure, and other improvements, they should be given the fullest publicity in the Agricultural Year Book and in the leaflets and other publications of the Department.

8. *The Jute Forecast.*—The experiment of basing the jute forecast on a detailed census made by the panchayats of the jute cultivation in each union was repeated during the year. The check of the panchayats' returns was further organized, and though still incomplete, has undoubtedly enabled more trustworthy figures as to area to be published than was previously possible. The forecast for 1912 turned out to be approximately accurate. That for 1913 has been criticised as unduly pessimistic, but it is as yet too early to say whether these criticisms are justified. Further measures for improving the forecast and the methods of jute cultivation generally are now under the consideration of Government in consultation with the Jute Forecasts Committee of the Chamber of Commerce.

9. *Fisheries.*—Most useful work has been done during the year by Mr. T. Southwell, the Deputy Director of Fisheries, to whom the special acknowledgments of the Governor in Council are due for the vigour and ability with which he has carried on the duties of his Department. Knowledge of the habits of *hilsa* has been materially extended, and a survey is now in progress relating to the distribution of *hilsa* in the main rivers of this Province and of Bihar and Orissa, which is expected to yield definite results regarding the breeding habits of the fish. The investigation of carp culture has not yet led to any positive conclusions, but a good deal has been done to encourage the traffic in carp fry and to spread information regarding the causes which lead to unsuccessful results in breeding. Enquiries have also been begun into the breeding habits of other fresh-water fish of commercial importance. Propaganda work has been carried out among the fishermen at all the places visited by the Deputy Director and his staff, and considerable interest has been evinced. Leaflets in the vernacular dealing with fish culture in tanks and the transport and curing of fish have been widely distributed, and their contents verbally explained on every available opportunity. Finally, an investigation has been made into the fish requirements of the province, and Mr. Southwell is engaged upon the preparation of a scheme, which will shortly be made public, for the development of the marine and estuarine fisheries of this Presidency.

10. The report under review contains signs of progress in various directions. The valuable work being carried out by the scientific officers of the Department has reached a stage at which definite results appear to be in sight. Demonstration work is expanding, and the indications that the efforts of the Department are being appreciated by the cultivators are satisfactory. At the same time the Governor in Council is not entirely satisfied that the work of the different branches of the Department is sufficiently co-ordinated, or that the risks of its energies being dissipated on diffuse and indeterminate work are sufficiently appreciated. His Excellency in Council thinks that the time has now come when the Director should take stock of the situation in consultation with the scientific officers

of the Department, carefully classify the experiments which have reached a stage at which results can be demonstrated, and settle the lines on which further experiments should be conducted. He should then, still in consultation with the experts, decide on the best methods of carrying out demonstration work, on the staff required for the work and on the training which should be given to the staff before they are sent out into the villages. For all this organisation the services of a second Deputy Director are urgently required, and the Governor in Council trusts that his appointment will not be long delayed. The recent awakening of public interest in agricultural problems in this Presidency affords strong ground for hope that any sound and well devised measures of improvement will receive every support from the more influential sections of the community, many of whom have already displayed their interest in practical ways. Public spirit of this kind deserves and should receive every encouragement, but its growth will only be stimulated if the Department concentrates its efforts on definite schemes, which have been fully tested and can be confidently recommended as likely to increase the well-being of those who are engaged in what is still the greatest industry of this country.

By order of the Governor in Council,

J. H. KERR,

Secy. to the Govt. of Bengal.

B. S. Press—24 1 1914—5495C—750—E. J. H.

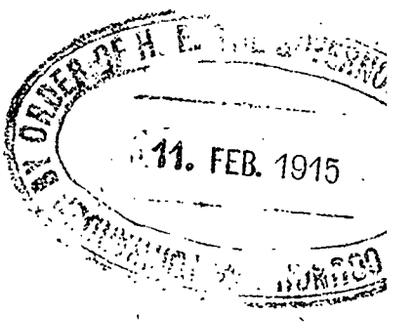
REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

FOR THE

YEAR ENDING 30TH JUNE 1914.



CALCUTTA :

BENGAL SECRETARIAT BOOK DEPÔT.

1914.

Published at the BENGAL SECRETARIAT BOOK DEPÔT,
Writers' Buildings, Calcutta.

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DEPARTMENT OF AGRICULTURE, BENGAL.

No. 7718 A.

FROM J. R. BLACKWOOD, ESQ., LL.B., I.C.S.,
Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

Dated Calcutta, the 17th November 1914.

SIR,

I HAVE the honour to submit the Annual Report of this Department for the year 1914.

The reports of the expert officers have been published separately *verbatim* and should be read along with the remarks contained in this report. In spite of considerable effort, we are still late in submitting the report, although not so late as last year. The *Puja* holidays intervened just after the jute forecast and more time has been taken by the printer this year owing to the greater amount of matter contained in the separate volume of the reports of experts. In order to have this report ready by the 15th of September, it will have to be in the hands of the printer before the 1st of September. A strenuous attempt will be made to have that done next year.

I have the honour to be,
SIR,
Your most obedient servant,

J. R. BLACKWOOD,
Director of Agriculture, Bengal.

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REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

For the year ending 30th June 1914.

INTRODUCTORY.

WITH the sanction of Government an important change has been introduced in the preparation of this report. The reports of the expert officers of the department have been published *verbatim* in a separate volume and in this report a general *résumé* of the work is given, in which emphasis is laid on the most important points. In previous years it was found impossible to describe the work of the various branches of the department in sufficient detail without submitting the departmental reports separately and at the same time to compress the report within the maximum limits laid down by the Government of India. The same method is followed in the preparation of the annual administration report of the Central Provinces.

CHAPTER I.

ADMINISTRATION.

2. I was in charge of the department throughout the year and Mr. D. N. Mookerji continued to act as Personal Assistant. Mr. F. Smith held the post of Deputy Director of Agriculture during the whole time except for the period from 29th September to 1st December 1913, when he was on privilege leave. Mr. D. N. Mookerji carried on the work of Deputy Director during that period in addition to his own duties. The appointment of a Second Deputy Director of Agriculture to be recruited direct from England has been sanctioned by the Secretary of State. He is expected to join shortly. Mr. A. A. Meggitt was Agricultural Chemist to this Government till 6th January last, when he went over to Assam as Agricultural Chemist under that Administration, and Mr. H. E. Annett from Pusa was appointed in his place. Mr. G. P. Hector continued to work as Economic Botanist. Mr. R. S. Finlow, Fibre Expert, who was granted 15 months' combined leave from 5th April 1913, was absent during the year. His work was carried on by the Economic Botanist and Agricultural Chemist jointly in addition to their own duties.

Mr. T. Southwell, assisted by Messrs. B. Das and S. M. Mohsin as Superintendents, held charge of the Fishery Department during the year. Of the two medical assistants entertained temporarily last year, one has been retained for another year.

In the Provincial Service Mr. J. N. Chakravarty, Agricultural Supervisor, held charge of the Dairy Farm at Rangpur, and Babu Rajeswar Das Gupta worked as Supervisor of the Dacca Division throughout the year. Messrs. N. N. Gupta and D. D. Dutt, who were appointed on probation to the Provincial Service last year, continued to work as Agricultural Supervisors of the Rajshahi and Chittagong Divisions, respectively. The question of making these two posts permanent is still under the consideration of Government. Two additional posts of Agricultural Supervisors for the Presidency and Burdwan Divisions have been sanctioned by Government temporarily

for one year and Babu J. N. Sirkar, an agricultural graduate of the Tokio University, was appointed to one of these posts on the 24th June 1914, and posted to the Burdwan Division. The other post has since been filled up by the appointment of Babu Hari Prasad Mitter, an agricultural graduate of the Cornell University.

During the year there were no important changes in the subordinate staff of the department.

Babu A. C. Ghose held the post of the Superintendent of Sericulture throughout the year. His headquarters, which were fixed at Berhampore, were transferred to Malda on the 3rd November 1913. Mr. M. M. Chakravarty continued in charge of the Mirganj Central Nursery. Mr. P. C. Choudhuri, who was appointed to the Provincial Agricultural Service temporarily for one year from 10th October 1913, was placed in charge of the Berhampore Central Nursery. Mr. Grangeon, who was appointed in place of Mr. F. D. Lafont to carry out hybridising experiments, joined his duties on the 23rd December 1913.

3. **Tours.**—I spent 128 days on tour during the year under report. I attended the Agricultural Conference at Coimbatore from 5th to 15th December 1913, and subsequently made a tour in Madras and the Central Provinces for the purpose of studying the working of the farms in these provinces, the systems of demonstrating agricultural improvements to the people and schemes which had been started for the improvement of cattle-breeding. At the end of the tour a report was submitted to Government. In touring in this province, I paid special attention to demonstration work, especially in the district of Mymensingh, to the preparation of figures for area and outturn in connection with the jute forecast, to the working out of the new sericultural scheme, to the Rangpur Dairy Farm and to the scheme of work on the other farms. The Deputy Director of Agriculture was mainly engaged in inspecting the working of the various farms. The Deputy Director of Fisheries, whose jurisdiction extends over the Province of Bihar and Orissa, spent 175 days on tour. Owing to the absence of a launch, enquiries with reference to the breeding-grounds of *hilsa* could not be continued; but a map has been prepared and published showing the distribution of *hilsa* in the rivers of Northern India. He also did a considerable amount of work in connection with the distribution of carp fry. He visited the Chilka Lake for the purpose of investigating the commercial possibilities of this area. He also did a considerable amount of work in connection with starting fishermen's co-operative credit societies. Propaganda work was carried out throughout the province. Fishermen were mustered and the possibility of forming co-operative credit societies was discussed. Improved methods of fish cultivation in tanks were taught chiefly through the agency of Municipalities and District Boards. Experimental hatcheries for the larger marketable predatory fish have also been established.

Mr. Meggitt was on tour for 50 days. He spent a good deal of time at the Jorhat Agricultural station in connection with sugarcane work. He also attended the meeting of the Board of Agriculture at Coimbatore. Mr. Annett was on tour for 31 days. He visited the Jessore district in connection with investigations into the production of sugar from the date palm and took soil samples from the various Government farms for analysis.

The Economic Botanist spent 56 days on tour. He visited Karimganj in the Sylhet district in order to draw up, in consultation with the Deputy Director of Agriculture, Assam, a programme of work for the new rice farm which has been established there. He also paid several visits to the Noakhali district and the Bikrampur subdivision for the purpose of inquiries in connection with the question of the *ufra* disease of paddy. He also visited several of the farms and attended the meeting of the Board of Agriculture at Coimbatore.

The Supervisors were occupied chiefly in demonstration work and in jute forecast inquiries in connection with the correction of the acreage figures and the determination of the average outturn of fibre per acre. They also attended the agricultural exhibitions in their areas. The Mycological Collector made inquiries chiefly in connection with the *ufra* and *bhapu* diseases of paddy. The Entomological Collector co-operated in these inquiries and also made

inquiries in connection with the mango weevil, ganja pests, the jute semilooper and the rice *hispa*. Officers of the Imperial Mycologist also visited Bengal in connection with *ufra* disease, diseases of sugarcane, potato blight and the bud-rot of cocoanuts.

The Superintendent of Sericulture spent 239 days on tour. He constantly inspected the various nurseries. He also visited the Punjab and the United Provinces in December 1913 as well as Bombay and Nagpur in January 1914 to make inquiries on the subject of bringing purchasers of silk into direct contact with the silk-reelers of this province.

The weaving master spent 201 days on tour and was occupied chiefly in introducing an improved form of reeling-machine to the notice of reelers. He also demonstrated the working of the automatic fly-shuttle loom. He organized co-operative credit weavers' societies at Bhanga, Paschim-sadardhi and Idilpur, but they have not yet been registered. Arrangements are also being made to start societies at Rajbari, Burirhat and Nurpur.

4. **New Schemes.**—(1) No entirely new scheme was started during the year under review; but considerable developments have been made in the new schemes to which reference was made last year. The new demonstration scheme is being gradually worked out. We have now a supervisor in each division. It is proposed ultimately to have an agricultural Inspector in each district and a demonstrator in each thana. Inspectors will, generally speaking, be agricultural graduates of Indian Universities and supervisors will be agricultural graduates of Universities in Europe, America or Japan. The number of demonstrators was increased during the past year from forty-seven to fifty-four. An account of the work done by them is given in the reports of the supervisors which have been separately published. In connection with demonstration work a proposal has been made to Government to establish divisional seed, manure and implement stores. A beginning has been made in utilizing co-operative credit societies for the purpose of financing agriculturists in purchasing such seeds, manures and implements as they require and it is intended to develop this system as much as possible. Two societies were formed in the district of Dacca at Mahakali and Khoshkhana primarily with the object of financing cultivators who desired to purchase bonemeal for manuring winter paddy. The Mymensingh and Faridpur Co-operative Banks are also financing cultivators in purchasing seeds and manures. In the initial stages of introducing demonstrations, the assistance of zemindars was found to be necessary in cases where an expenditure of money was required in the first instance. It has now been found that this assistance can be dispensed with. Programmes of demonstration were also drawn up in consultation with District Officers and Commissioners of Divisions for demonstration work in Government and Wards' Estates.

(2) Possession of the land of the Rangpur Dairy Farm was given by the Land Acquisition Deputy Collector in November 1913. Possession of waste land was taken in the March preceding and the purchase of cows was commenced from that time. During the past year work has been confined to the erection of buildings, to the purchase of as many suitable cows as possible and to the reclamation and laying out of the land. Great difficulty has been experienced in purchasing suitable cows. It is hoped that the required number will be obtained during the coming cold weather.

(3) As regards sericultural work, the French Expert, M. Lafont, was compelled to leave India on account of illness and his work was taken up by M. Grangeon who has submitted a report. A new nursery was started at Piasbari in the district of Malda and the Bogra nursery was completed. It is now intended to exchange seed between nurseries instead of obtaining the supply from professional rearers, as was previously the practice.

(4) In connection with the work of compiling the jute forecast, a conference was held by the Honourable Member in charge with the members of the Jute Forecast Committee of the Chamber of Commerce for the purpose of working out a scheme for the improvement of the procedure in preparing the forecast. The scheme proposed was not, however, subsequently approved; but a considerable temporary establishment was engaged by the department for the purpose of checking the entries in the jute forecast schedules of the

punchayats. The work of estimating the average outturn per acre by means of extensive enquiries was also continued. As the establishment of the department is strengthened, the present scheme can be gradually perfected.

(5) At the recent Agricultural Conference at Coimbatore, dissatisfaction was expressed with the programme of work on the Bengal farms. An attempt was accordingly made at a conference held at Dacca in the month of March to work out an experimental scheme for the farms, in which the object of each experiment should be definitely stated. A copy of the scheme so prepared is published as an appendix to the reports on the agricultural farms.

CHAPTER II.

AGRICULTURAL EDUCATION.

5. There is no Agricultural College in this province; but some Bengali students attend the Agricultural College at Sabour. The Principal of that College reports that all the eleven students of the third year class secured a diploma and most of them have been appointed to Government posts. Only four out of seven of the second year students passed and both the first year students were successful at the annual examination of the College. For the session 1914-15 six students from Bengal have obtained admission to the first year's class.

Nature study continues to be part of the curriculum of primary schools. The teachers explain to the boys the natural phenomena which the boys themselves observe, and the teachers of *guru*-training schools sometimes take boys out to the fields for observation of natural phenomena. It is again reported that teachers capable of giving such lessons with advantage are very rare. In one case the boys were unwilling to work in the school garden and their guardians supported them.

At a conference held at Dacca in March last a scheme for the education of sons of gentlemen in agriculture was discussed. A prospectus of a course which, it is proposed, should last for one year, has been prepared; but it will rest with the landed community to say whether they really want this instruction in view of the fact that the Sabour College is able to take in more pupils than it has at present. The system of training apprentices on the farms is being extended. A number of the apprentices, so trained, have subsequently been appointed demonstrators. It will now be possible to give a training in dairying at the Rangpur dairy farm.

CHAPTER III.

RESEARCH AND EXPERIMENTS.

1.—AGRICULTURE.

6. In previous annual administration reports, the reports of the Deputy Director of Agriculture on the Agricultural farms were published as Appendix I to the report of the department. On the present occasion they have been published in a separate volume *verbatim* with the reports of the other expert officers of the department. The Deputy Director has written the reports of the Chinsura, Dacca, Burirhat, Kalimpong, Rajshahi, Rangpur and Burdwan farms. The report of the Rangpur Dairy Farm has been written by the Superintendent of the farm and the report of the Chittagong model farm has been compiled by the Sadar Khas Tehsildar of Chittagong.

At the meeting of the Board of Agriculture at Coimbatore in December last, the programme of work in the Bengal Agricultural farms was adversely criticised and it was pointed out that definite experimental work was not being done. In the Government Resolution on the report of last year I was asked to settle the lines on which future experiments should be conducted. The reports of the Deputy Director for the past year will show that a considerable advance has been made on the work of previous years. Under the heading of " experimental work " a statement is given of a number of definite problems

and the results obtained are given in detail. In the case of the Dacca Farm, it has been found that the *Malati*, *Dadkhani* and *Badshabhog* varieties of winter paddy are the most suitable varieties for the soil of that farm. In the case of *Aus* paddy, the best results have been obtained from the *Boaljuri* variety. In the case of sugarcane the best results have been obtained in the case of striped Tanna, yellow Tanna, B. 147 and B. 208. As regards jute the results of the past year were in favour of the *Olitorius* variety. Pitted manure was compared with unpitted manure and the results were in favour of the former by $2\frac{3}{4}$ maunds of grain per acre.

The work of this farm suffered from the outbreak of disease among the Farm bullocks in October 1913. Two bullocks died and the rest recovered only after prolonged treatment.

In the case of the Chinsura Farm the manurial experiments go to show that an application of 50 maunds of cowdung per acre gives on the whole the best results economically. A comparison of outturns for successive years shows, however, that they are extremely irregular and it is not easy to draw any definite conclusion from them. The same remark applies to the experiments in connection with manurial residues. The variety experiments in rice go to show that *Nagra*, *Badshabhog*, *Dadkhani* and *Banktulsi* are the most useful varieties. In the case of the seedling experiments the results confirm the conclusion previously arrived at, that the transplantation of one seedling gives the best results if the transplantation is made not later than July. It has also been found that a spacing of 10 inches is the best distance between two seedlings.

The Rangpur Demonstration Farm did good work in distributing jute, paddy and mustard seed and sugarcane cuttings. *Badshabhog* has been found to be the most suitable variety of rice for the soil of this farm.

The Kalimpong Farm has done good work in producing selected seed of maize true to type. Five varieties have been isolated: yellow round, yellow flat, white round, white flat and red round. It has been found that the most economical rotation is maize and *kodo*. It has also been found that orange, lemon, papya and plantain can thrive on the hillside at Kalimpong.

From the Burdwan Farm 4,030 *khari* sugarcane cuttings and 6,630 Java cuttings were distributed to raiyats.

The Rajshahi Farm distributed 35 maunds of jute seed, 8 maunds of cowpea seed and 27 maunds of oat seed. Eight thousand sugarcane cuttings were also distributed from this farm.

As regards the Burirhat Farm, it has been definitely ascertained that the area suitable for growing tobacco on this farm is not more than 10 acres, of which only half can be said to be really good land. It has been decided that the growing of tobacco in future on this farm will be confined to this land and that any further land that may be required will be obtained on the Dairy Farm. The attempt to acclimatize foreign tobaccoes, although it has so far not met with much success, will be continued; but greater attention will be paid in future to the improvement by seed selection of the various varieties of native tobacco. Those plants will be selected for seed, which possess the qualities required by the Burma buyers. It is also intended to make a survey of what is known as the " Tobacco belt " in the Rangpur district.

The objects of the Rangpur Dairy Farm have been described in detail in the report of the Farm Superintendent. The central object of the farm is to develop a good type of milk-yielding cow and a good type of draught bullock, suited to the climatic conditions of Bengal. In carrying out the main object of the scheme, two other minor objects emerge. The first is to show the possibilities of what is known as mixed farming, *i.e.*, farming in which the rearing of live stock is combined with the growing of crops. In this connection an attempt will be made to show that pasture can be profitably grown in rotation with other crops and that what are known as fodder crops can be grown with a profit. The second object is to supply an adequate quantity of pure milk to the local market. These two objects are, however, subsidiary to the main scheme and will give way, whenever they come into conflict with it. Strenuous attempts have been made during the year to purchase as large a number as possible of the best local cows now available. This has been found to be a most difficult task. Such cows are extremely scarce; and where they

do exist, it is extremely difficult to get the owners to part with them. After a year's work we have only been able to secure half the number we require; but strenuous attempts will now be made to secure the full number.

In spite of the fact that only the best local cows were purchased, it has been found that the average yield of milk per diem is something like two seers only for from 8 to 9 months in the year after the calf has been allowed an adequate supply of milk. So that the total milk yield of a very good Bengal cow at present is not much over 500 seers per annum. A few of our cows yielded, however, over 700 seers per annum. The main problem, therefore, is to bring up the average annual yield from 500 to 700 seers per annum, allowing at the same time an adequate amount for the calves. It may be possible even to exceed this yield; but, if certain cows now in existence give a yield of 700 seers per annum, after an adequate amount of milk has been given to their calves, it is clearly possible by sufficient effort to produce a herd which will approximate to this type.

Progress in such a work will of course be slow; but that is no reason why the work should not be undertaken. It has to be clearly recognized that all progress in this department must be slow. It is not a question of the rate of progress but of its existence.

As regards the question of the utility of mixed farming it is not possible to make any definite pronouncement at the present stage, as possession of the land was only given in November of last year. There is a certain amount of pioneering work to be done; but in the next annual administration report, it will probably be possible to at least foreshadow what the results will be, if a definite pronouncement cannot then be made.

As regards the question of supplying milk to the people, this side of our work is very greatly appreciated by the public. I consider it desirable that the number of cows on the farm should be increased up to the point at which the purely local demand for sweet milk has been satisfied. At the present moment it is very far from being satisfied.

If once this farm was in full working order and a considerable number of good female calves were produced annually, it would be possible to start other farms of a similar type more easily than the Rangpur farm. This point should, therefore, be kept in view.

As regards the farms for which the Deputy Director has submitted reports, attention is drawn to the experimental schemes which have been prepared and which it is hoped, will be carried into effect during the coming year. Seed selection on the principle of single line cultures, occupies a prominent place in these schemes in the case of each of the farms.

2.—FIBRES.

7. The report on fibres has been submitted on the present occasion by Mr. Hector, who carried on the work of the Fibre Expert during Mr. Finlow's absence on furlough. For several years past Mr. Finlow has been engaged in trying to develop a superior race of jute by selection of seed on the pure line culture system. Both the outturn per unit of area and the quality of the fibre have received attention. Before proceeding on leave, Mr. Finlow had a considerable quantity of his seed grown at Pusa and he hopes to be able to show that these pure cultures are absolutely better than any other race in cultivation in Bengal. Steps will be taken next year to test Mr. Finlow's seed against the seed of the best local varieties. It will be easier to do this, as Mr. Finlow has come to the conclusion that jute is normally self-fertilized. The demonstrators of the department will also send samples to Mr. Finlow for the purpose of having them tested in the Dacca Farm alongside of his seed. A sufficient area has been allotted to Mr. Finlow on all the suitable agricultural farms for the propagation of his seed.

Further, with a view to improve the outturn of jute per acre, each demonstrator in a jute area conducted a certain number of demonstrations in plant to plant selection. The practice of the ordinary cultivator is to utilize a few plants in the corner of his field for seed and these plants are frequently very inferior. There is a strong temptation to use inferior plants for this purpose, especially when the price of jute is high as it was last year. The

object of the system of plant to plant selection is to utilize selected individual plants for seed and to carefully preserve the seed afterwards until the time of the next sowing. The system was only started last year. This year arrangements were made to test the outturn of selected seed against that of ordinary seed obtained in a haphazard manner. Mr. Finlow and Mr. Hector are not hopeful that any advantage will be gained from this system of plant to plant selection; but it is intended to proceed with the work and to test the results by actual experience. A few results have been obtained just before this report was sent to the Press and show an increase in outturn in every case from the selected seed.

If once it were clearly established that a really superior seed had been evolved, the question of starting seed farms on the model of the system followed in the Central Provinces and Madras, would be introduced. But it would be premature to start such farms until the superiority of a particular kind of seed has been absolutely established.

The manurial experiments which were commenced in 1911 in connection with the effects of lime and phosphates on red soil were continued at Dacca. The results prove that the application of these manures effects an immediate improvement and arrangements are being made to demonstrate the results in similar tracts.

A certain amount of work was also done in connection with other fibres, *Agave*, *Sida* and *Urena Lobata*. As regards *Sida*, Mr. Hector is of opinion that it is worth 20 per cent. to 30 per cent. more than ordinary jute. But as its yield per acre is 30 per cent. less, it is not likely to displace the better known fibre.

3.—AGRICULTUaAL CHEMISTRY.

8. Mr. Meggitt acted as Agricultural Chemist of this province and the province of Assam up till January 1914, after which time the work was taken over by Mr. Annett, who has written the departmental report. He remarks that Mr. Meggitt gave much of his time to Assam in connection with cane sugar work at Kamrup and Jorhat. The only work he did at Dacca was in connection with the lime, phosphate and green manuring experiments to which reference is made by Mr. Hector in his report on fibres.

Mr. Annett, since he has joined, has taken up various items of investigation. He has analysed the juices of the various varieties of sugar-cane grown on the Dacca Farm for the purpose of finding out the percentage of sucrose in the case of each variety. He has found that, as regards the question of the percentage of sugar in the juice, the following is the order of excellence :—

(1) B. 207.
(2) B. 147.
(3) Dacca *Gandheri* and yellow Tanna.
(4) Striped Tanna.

With reference, however, to the amount of sugar extracted per acre, the varieties came out in the following order :—

(1) Striped Tanna and yellow Tanna.
(2) B. 147.
(3) Dacca *Gandheri*.
(4) B. 208.

The experiments warrant a further trial on a larger scale of yellow Tanna and B. 147. Work is also being done in connection with the important question of the date palm sugar industry. The Agricultural Department made experiments in 1892-94 for the purpose of showing the advantage of making jaggery from the juice of the palm in shallow iron pans instead of in the deep earthen vessels in common use. Experiments were also made to drain off the molasses by means of the centrifugal machine or turbine. These experiments, however, were not successful owing to the increased cost of fuel used up by the shallow iron pans and the increased cost of the pans themselves. At the instance of the Agricultural Chemist, a scheme has been sanctioned under which the effect of using iron buckets for collecting juice will be tested against that of using earthen pots. It is also proposed to experiment with the American type of furnace used for the production of maple sugar. Mr. Annet is of opinion that there will be an economy of fuel by the use of this furnace.

The Tarpur Sugar Works in the Jessore district has done good work in showing that white sugar can be produced direct from the juice of the date palm without first converting the juice into jaggery. Mr. Annett remarks that the manufacture of this white sugar is extremely simple and the juice requires no bleaching or clarification. As the price of sugar is now likely to rise, there appears to be a possible opening here for the development of a large industry, if a suitable amount of capital is forthcoming.

Mr. Annett is also engaged in a scientific investigation to elucidate the mechanism of the production of the sugar in the palm tree. He is also engaged in a scientific study of the enzymes present in the various Indian seeds. He has found that the sword-bean contains a ferment which can rapidly change urea into ammonium salts. This discovery can be made use of for the purpose of determining the proportion of urea in urine or blood.

Mr. Annett is also engaged on the important question of making a soil survey of the province. As the work progresses, he hopes to be able to define the boundaries of the different classes of soil which exist in the province. He also did some work in analysing the contents of manures and food-stuffs; but the results have not yet been published. Work is also being done in investigating the chemical nature of the nitrogen compounds stored up in the nodules of leguminous plants used for green manuring. Work is also being done in connection with the question of soil denudation. Samples of soil have been taken from certain high and low areas in the Rangpur Demonstration Farm as well as from the Dacca Farm; and an attempt will be made to determine the amount of fine soil washed from high to low areas during the heavy rains.

From the above description of Mr. Annett's work it will be seen that he has made out a very interesting programme. The soil survey of the province, which has been taken up, is an inquiry of the highest importance. So also are the investigations in connection with the sugar industry and the contents of manures, food-stuffs and the root nodules of leguminous plants.

4.—BOTANY.

1.—Rice.

9. (1) **Pure line cultures.**—The Economic Botanist, Mr. Hector, has now studied in detail for three seasons the characters of over 200 types of transplanted *aman* paddy and has isolated half a dozen of the best of these for testing on a field scale. Last year (1913) (in spite of an unfavourable season) the outturns of these selected types varied from about 1,400 lbs. to over 2,100 lbs. per acre. The variety or type that heads the list in point of outturn, namely, *Indrasail*, is again being tested this year (1914) on a much larger scale not only at Dacca but also at Chinsura, Rajshahi and Rangpur.

Work on similar lines is being carried on with *aus* paddy also.

Natural cross-fertilization in rice has now been proved to be of fairly frequent occurrence. Mr. Hector has obtained a large number of these natural hybrids in his pure line plots, and it is possible that some of these may prove economically valuable. Work on hybridization, with a view to study the inheritance of some of the chief differentiating characters has been continued.

(2) **Seed-rate and specific gravity selection experiments.**—Other things being equal, it is better to sow heavy seed than light seed. In Japan heavy seed is separated from light by the help of a solution of common salt. When ordinary seed is thrown into such a solution, the strength of which can easily be varied at will, the light seed floats on the surface while the heavy seed sinks to the bottom. This simple method of selection by specific gravity may be very usefully adopted by the Bengal raiyat who, especially in the case of *aus* paddy, uses very bad seed and too much of it. During 1913, Mr. Hector's experiments gave very promising results. The selected seed sown less thickly gave a much larger outturn per acre than unselected seed sown at the local rate. In another set of experiments in the same series the outturn was doubled by simply halving the local seed-rate. These experiments are being continued.

(3) **Ufra disease of rice.**—Some experiments to test the effect of thorough ploughing and stubble burning during the cold dry months were started in December 1912 in the Bikrampur Subdivision of the Dacca district and in Chaumahuni in the Noakhali district. The disease had been very prevalent in these tracts; but curiously enough it did not appear in 1913, and so no conclusion can be drawn as to the efficacy of the measures. The plots chosen for these experiments, however, are open to the objection that it is not possible

to control the inflow of water and so prevent their infection from outside. At the instance therefore of Dr. Butler, land has been taken at Comilla where it may be possible to prevent outside infection. It is proposed to carry on experiments there in preventive measures over a number of years under as careful control as possible.

2.—Other Crops.

10. (1) The work on oil-seeds was continued. The isolation of types *Brassicas* and *Sesamums* and the maintenance of their purity is found to be complicated by the fact that both are to a large extent cross-fertilized.

(2) Work on varieties of *Phaseolus mungo*, Linn. (*mati kalai*) was continued and some fifteen distinct types have been isolated. Chemical analysis has shown that there are considerable differences in the nitrogen contents of these types.

(3) The types of chillies isolated are being further studied and some cross-fertilization work has been done.

(4) The experiments started in 1912 to test the possibility of growing a green manure crop between the early paddy crop and the subsequent *rabi* crop were continued and the results were again satisfactory. As in the previous year the experiment was tried with cowpea, mustard being chosen as the *rabi* crop. In one case the cowpea was sown about the middle of July after harvesting an early variety of rice and in another case it was sown a fortnight later after harvesting a late variety of rice. In both cases the cowpea was ploughed in at the end of August when it was seen that the extra fortnight made a big difference in the appearance of the crop. The outturn of mustard, however, was not good but it was distinctly in favour of the first.

(5) The fruit experiments were continued. Litchis, guavas and custard-apples are now bearing and promise to do well. The figs have also borne a few fruits of fair quality. The citrus fruits have proved a failure and have been mostly removed. Ten different varieties of Malda mangoes were added to the area during the year under review.

5.—ENTOMOLOGY.

11. The Imperial Entomologist (Pusa) has submitted a report showing the insect pests sent to him from Bengal, which were identified by him in the course of the year. A rice pest sent from the Noakhali district turned out to be the well-known *hispa* and another pest sent by one of the lady missionaries at Serampur turned out to be *Epicephala chalybaema, Mayr.*

The Bengal Entomological Collector works under the orders of the Economic Botanist. He has submitted a report under his own signature and has noted the following as the chief items of his work :—

(1) The investigation of the *Bhapu* disease of paddy in Western Bengal. He believes that it is due to a dipterous insect which he has identified as *Fam Cecidomyiidæ.*
(2) Experiments to check the mango weevil by kerosene oil treatment.
(3) Treatment in connection with the red spider, a serious pest of Ganja. Vermisapon Special K. was tried and is reported to have produced good results.

The Entomological Collector has also made an interesting list of the insect pests observed on the Dacca Farm in the course of the year. He also prepared a list of the injurious insects of Bengal for the Imperial Entomologist. He also published a leaflet on insect pests and general measures for their prevention and remedy and also a short treatise on rice pests.

In the month of July this year, owing to the deficiency of the rainfall in the previous month, the jute crop was attacked in some districts by the semilooper, especially in the districts of Murshidabad, Nadia and Jessore. The chief remedy proposed for dealing with this pest is to drag a rope across the plants and so worry the caterpillars. Another remedy is to assist birds in feeding on the pests by erecting branches of trees in the fields.

At the various agricultural exhibitions, diagrams of insect pests were exhibited, and their life histories explained together with the various remedies known for their destruction.

6.—MYCOLOGY.

12. The Imperial Mycologist (Pusa) has submitted a report regarding the work done by that department in Bengal. Dr. Butler published a bulletin describing the *ufra* disease of paddy which he discovered was due to an eel-worm. The bulletin has been translated into Bengali. Experiments are being continued by the Imperial Mycologist to find out a remedy for the disease. Work was also done on the smut of sugar-cane, potato blight, anthrænose of betle-pepper and bud-rot of cocoanuts.

The Mycological Collector, who works under the Economic Botanist, has submitted a report under his own signature. His main work was in connection with the *ufra* experiments; but he also dealt with the *bhapu* disease of paddy, potato blight, and the bud-rot of cocoanuts. He states one important fact, if correct, in connection with the *bhapu* disease of paddy, that it damages only transplanted paddy, while *ufra* is a disease chiefly of broadcasted winter paddy, although it attacks transplanted paddy also.

Lectures were given at the various agricultural exhibitions, in which the life history of the more important parasitic fungi prevalent in the province was explained and the methods of combating them. The Mycological Collector also made a complete list of the parasitic fungi observed during the year in the Dacca Farm and its vicinity.

7.—SERICULTURE.

13. As was stated in the report of last year, M. Lafont, the French Sericultural Expert, was compelled to leave India on account of illness. His aim was to develop a type of cocoon superior to the native varieties, which would not degenerate when exposed to the Bengal climate. After he returned to France, he submitted a report which was published in the course of the year. He found that the attempt to convert univoltine races of silk-worms into polivoltine by acclimatisation was a failure in Bengal, although the attempt had been successful in Madagascar. As regards the experiments in crossing, there was not sufficient time to see whether any permanent results had been secured. It was pointed out several years ago by M. Lefroy that, although cross-bred worms are superior in the first generation to the native varieties, they rapidly deteriorate afterwards, as they cannot stand the climate of Bengal, especially in the period from July till October. To get over this difficulty, M. Grangeon, who has submitted a report, proposes to keep the seed-cocoons in the hills from July to October. A scheme to carry out this idea has already been put into operation. A small nursery has been established at Kurseong and some mulberry has been planted. It is intended to make a trial of the scheme next year. It remains to be seen, however, even supposing the scheme is successful (which has yet to be proved) whether the increased cost will not render it prohibitive as a practical measure. M. Grangeon has unfortunately been called away for duty at the front and his work is in the meantime being carried on by Mr. Probhat Chandra Chaudri.

The new scheme for the supply of seed-cocoons free from disease to the whole province was described in the report of last year. It is to be noted that, by the establishment of a nursery at Bogra and a nursery at Malda, a very important change in procedure has been introduced, inasmuch as, instead of obtaining seed-cocoons from village rearers (as was previously the practice) and eliminating the cocoons which were diseased, the procedure now is to exchange seed between the various nurseries. As pointed out by the Superintendent of Sericulture in his report, the Bogra nursery is used for the rearing of *Chhotapolu* or *deshi* seed. Previous to the opening of this nursery all that was done in this matter was to rear a small quantity of this seed in a hired house at Bogra, which was a most unsatisfactory arrangement.

It was found that the system in force of having branch nurseries was unsatisfactory and the branch nurseries have therefore been closed. It is proposed to bring the central nurseries up to their maximum strength. The maximum is determined by the amount of labour available in the vicinity.

No advance was made during the past year in turning out a larger quantity of seed-cocoons free from disease. It is hoped, however, that a considerable advance will be made next year. The closing of the branch nurseries explains to some extent this result. The Piasbari and Bogra nurseries were only just brought into operation in the course of the year and the land has only just been acquired for the Amriti Nursery in Malda.

With a view to making out a complete scheme for the province it was found necessary to take a mulberry census by the agency of panchayats. It was not found possible to complete this work before the close of the year, as energy had to be concentrated on the work for the jute forecast. It is expected, however, that the work will be finished soon.

The work of disinfection of village rearers' houses was continued during the year. Sulphur and copper sulphate were sold to the rearers at cost price and instructions were given as to the method of fumigation. A centre for the sale of sulphur and copper sulphate has been opened at Malda.

There was a sericultural class attached to the Berhampore Central Nursery which was attended by six students. One student passed the final examination and received the usual reward of Rs. 250 for building a model rearing house. He has completed the house and commenced rearing according to the system of Pasteur.

There were eleven pupils in attendance at the Rajshahi Sericultural School at the beginning of the year. Eight presented themselves at the final examination held in December 1913, and five passed. As regards the three students of 1912, who received Rs. 100 each as the first instalment of the reward of Rs. 250, only one made sufficient progress in the erection of his rearing house to merit the second instalment of the reward. This result is not very satisfactory; but it is absolutely essential that the full reward should not be paid until it has been shown that the money will be spent on the purpose for which it was intended. Steps will be taken to recover the first instalment from those students who fail to make reasonable progress in the erection of a model rearing house.

During the course of the year the Superintendent of Sericulture paid a visit to the Punjab, the United Provinces, Nagpur and Bombay, with the object of bringing silk-reelers into direct contact with purchasers and to counteract the pernicious influence of middlemen who take advantage of the ignorance of the reelers to beat down prices. It is hoped that this visit will have good results.

8.—FISHERIES.

14. Mr. Southwell has been incharge of the department throughout the year and has submitted an elaborate and very interesting account of his work. He was assisted by Messrs. Das and Mohsin. As remarked by him, the department is a new one and has to deal with problems of great magnitude and of even greater economic and scientific importance. The main problem before the department is to show how the fish-supply of the province can be increased, either by increasing production, by suggesting improved methods of capture, by preventing the destruction of immature fish, by improved curing processes or by facilitating the transport of fish to the market.

Mr. Southwell has been engaged for some time in investigating the question why Indian carp do not breed in confined waters. He has not yet been able to submit his final report; but he is satisfied that Indian carp will only breed in running water. The discovery which Mr. Southwell has made, viz., that the eggs of *hilsa* sink low in the water while those of carp float on the surface is one of great interest. The breeding-grounds of the *hilsa* have still to be investigated; and for this purpose a launch is necessary. It is hoped that the launch will be ready by next year. When once the breeding-grounds have been discovered, it will probably be possible to increase production by artificial hatcheries, which will be started immediately afterwards. The want

of a launch also precluded any work being done regarding *betki* and *topsy* fish. With regard to carp culture in tanks, Mr. Southwell has made an important recommendation that either the tank should be cleared entirely of predaceous fish or all the fish in the tank should be predaceous. Some predaceous fish breed in tanks. These fish can be relegated to tanks which are unsuitable for the cultivation of carp. When fry are originally put into tanks, they are so small that predaceous fish cannot be distinguished from those which are non-predaceous. The result is that, when the fish grow up, the non-predaceous fish are devoured by the predaceous. If the former are much more numerous than the latter, such a tank will in the end have very few fish. It is, therefore, important that, before fry is introduced into a tank, the fry should have reached a stage of development at which the two varieties of fish can be distinguished.

A large quantity of fry was supplied at market rates to tanks under the charge of public bodies. Arrangements were made with the various Railway Companies to allow consignees to take the *handies* (or vessels containing fry) into the train with them, so that they could be attended to on the way. It is intended to extend this side of our work as much as possible and to supply young fish in place of eggs or fry at the same market rates. It is also proposed that attention should be devoted to mitigating the extensive mortality which occurs in nature among eggs and fry at the mouth of the river Damodar. With a view to this object, 70,000 fry were placed in selected tanks in the Burdwan district, the idea being that they should be returned to the river after they had attained a suitable size. This project was spoiled by the unusual floods which occurred last year. But two tanks at Amta have been stocked with 30,000 fry, which will be placed in the river, after they have hatched out and attained a suitable size. Similar fry have also since been introduced into the Burdwan tanks.

The problem of how to utilize the co-operative credit society movement for the improvement of the production and distribution of fish, is of the very highest importance and has engaged the attention of Mr. Southwell during the year. These societies may take the form of enabling fishermen to purchase instruments of capture. They may be utilized for facilitating transport to the market. They may also be employed to enable fishermen to meet the expenses of curing before the time of sale. They can also be used to enable fishermen to purchase leases direct without the intervention of middlemen. One society has already been formed in the district of Bakarganj. Other places in Eastern Bengal appear promising for the purpose of starting further societies. Advantage was taken of agricultural exhibitions to instruct fishermen in the work done by the Department.

Mr. Southwell also worked out a very important scheme for initiating trawling on commercial lines in the Bay of Bengal. He is also preparing a similar scheme for opening out the Sunderbans fisheries. He also made an important statistical inquiry regarding the fish trade of the province. The scheme for trawling in the Bay of Bengal was published as a bulletin of the department. It is hoped that some private individual, into whose hands the bulletin may fall, may take up the scheme of exploiting the marine fisheries of Bengal. The chief difficulty is that of fast transport. After the fish are caught, they have to be taken to the Calcutta market in a short time. For that purpose very fast transport is necessary, and it is on this that the success or failure of the scheme mainly depends.

Experiments were made at Goalundo to test the effect of Sollings' paper in preserving fish. Mr. Southwell has come to the conclusion that, considering the trouble, labour and cost involved, the process does not appear to have any marked advantage over the ordinary method of packing fish in ice. Mr. Southwell also made an investigation regarding the possibilities of trout culture in the streams of the Himalayas; but he found that there was no prospect of carrying out any scheme of this nature with any hope of success. He is, however, of opinion that hatcheries can be established with advantage for the cultivation of *mahseer*.

Part of Mr. Southwell's report is devoted to work in the province of Bihar and Orissa. The report shows that a considerable advance has been made in the work of this department in the course of the year.

CHAPTER IV.

AGRICULTURAL ASSOCIATIONS, SHOWS AND AGRICULTURAL DEMONSTRATIONS CONDUCTED BY THE DEPARTMENT AS WELL AS BY AGRICULTURAL ASSOCIATIONS AND PRIVATE PARTIES.

15. **Agricultural demonstrations conducted by the Department.**—This branch of the work of the department has received great attention during the past year. Reports for the Dacca, Rajshahi and Chittagong Divisions, have been written by the Supervisors. The Superintendent of the Rangpur Dairy Farm has submitted a separate report for the Rangpur district only.

It will be observed that definite results of the demonstrations have been tabulated in the reports of the Supervisors and full publicity will be given to them. As the system which has been adopted in the past year is a new one, it is desirable to describe it in some detail.

As regards the bonemeal demonstrations, the procedure observed was as follows:—A plot having been selected and manured, a check plot was fixed on alongside the manured plot. It is assumed for the purpose of these demonstrations that the check plot is of similar fertility to the manured plot before it was manured. It was measured to be of equal area. The selection of the plots was made in the first instance by the Supervisor or the Agricultural Inspector. The ploughing of the land was done by the raiyat and the bonemeal was spread by the local demonstrator with the help of the raiyat. The demonstrator was again present at the time of harvesting of the crop. The Supervisor of the Division and the Agricultural Inspectors visited as many cases as they could find time for. The outturn of the crop was in each case weighed by the demonstrator. The result was not in every case in favour of the manured plot. The best results have been obtained in the Dacca Division. The results obtained in the Rangpur district have not been on the whole very satisfactory in the case of this particular demonstration. There were altogether 551 plots, which were made the subject of this demonstration in the three Divisions of Eastern Bengal, and very considerable increases in outturn, giving a net profit, have been obtained in a large majority of cases. The success of the demonstration has been proved by the number of private orders for bonemeal which have been received from cultivators. When the scheme was first started, it was found necessary to induce zemindars to advance money to their raiyats for the purchase of bonemeal. It has now been found that such assistance can be dispensed with. Increasing use will in future be made of co-operative credit societies for the purpose of financing cultivators.

Potato demonstrations were carried out in 556 plots. In the case of these demonstrations, as the object is the introduction of a new crop, there was no check plot. The best result was obtained by Babu Satish Chandra Mukherji of the Rangpur district, who obtained an outturn of 360 maunds (13 tons) per acre.

In carrying out demonstrations in connection with the conservation of cowdung, 478 pits were dug during the year and covering, usually of ordinary thatch, erected over them. Considerable difficulty is frequently found in convincing cultivators of the value of conserving the manure; but when once they hear of the good results obtained by other cultivators, who have adopted the practice, the popularity of this demonstration will spread.

A considerable number of Meston ploughs and Planet Junior hand-hoes were sold to cultivators in the Eastern Bengal districts and specially good work was done in this respect in the Rangpur district. The superiority of the Meston plough over the native plough is most marked in ploughing loose friable soil. It is for this reason that this plough has become so popular in the Rangpur district.

The work which has been done by the demonstrators of the Department in seed selection of jute and paddy is of such importance that it is desirable to describe the procedure in some detail. The selection of the field was carried out by the Supervisor or Inspector in the first instance. Either of these officers

was also present at the time when individual plants were selected for seed. After selection had been made, a piece of tape was tied round the plant. In the case of jute, thickness, height and absence of branching were the chief points which were considered in making the selection. In the case of paddy the number of shoots in a clump and the total number of grains in the plant were regarded as most important. The demonstrators were present when the seed was gathered in by the raiyats. The seed was then carefully preserved by the raiyats themselves in closed jars till the time of sowing.

After this selected seed had been sown in a definite area, an equal area of similar fertility was sown with seed obtained in any way at all, which is the usual practice. The outturns of the two plots were carefully weighed in presence of the demonstrator and any superior officer who could find time to be present. It is not possible to publish all the results in this year's report. But some results have already been obtained and show an increased outturn in every case from the selected seed. These results will be given the widest publicity. It is intended to continue this work of selection year by year and to compare the outturns of this seed with that of ordinary seed.

A certain amount of work was also done in distributing cuttings of superior varieties of sugarcane grown at the farms, especially Dacca *Gandheri* striped Mauritius and Barbadoes varieties. It is intended to extend this branch of work as far as possible in future.

16. **Agricultural Associations.**—The Provincial Association held two meetings in the course of the year. The Burdwan and Presidency Divisional Associations each received a grant of Rs. 1,000, which they distributed among the different District Associations under them. Only 9 out of the 32 members of the Burdwan Association attempted any work. The crops of four members were destroyed by the floods. Only two members of the Presidency Association undertook any work. Mr. S. P. Chatterjee distributed a maund (82 lbs.) of Australian potatoes among some other members and a certain number of cultivators. It is reported that outturns ranging from 165 to 210 maunds (6 to 7⅔ tons) per acre, were obtained.

In Western Bengal the new demonstration scheme has not yet been introduced. Demonstrations are carried on in this part of the province by the various District Associations. The heavy rain and floods of the past year interfered with the work of the District Associations. Babu Adwait Charan Samanta, a member of the Burdwan Association, secured an outturn of 45 maunds (1⅔ tons) of paddy per acre by the application of one maund of bone-meal and 10 seers (20 lbs.) of saltpetre. The net profit per acre in this case was Rs. 65-4. Babu Rama Prasanna Mukherji, a member of the Birbhum Association obtained an outturn of 210 maunds (7⅔ tons) of potatoes per acre with both the Nainital and Patna varieties, using cowdung and castor cake. Maulvi Chaudhuri Zillar Rahman, a member of the Rampur Hât Branch Association, obtained good results in the case of Patna potatoes. The demonstration work undertaken by the members of the Bankura Association was not successful but some attempt was made to reach the cultivators and to interest them in new and approved methods of cultivation and in the use of improved implements. Very few members of the Hooghly Association took any interest in the agricultural development of the district. All the demonstrations attempted by its members proved a failure, owing partly to the occurrence of heavy rain and partly to ignorance as to the proper time for the operations. The floods of the year were chiefly responsible for the members of the Midnapore District Association not being able to do any useful work. Several members of the 24-Parganas and Nadia Associations undertook some demonstration work. Two chain pumps were purchased by the 24-Parganas Association for demonstration amongst the cultivators. Babu Surendra Nath Ghosh, a member of the 24-Parganas Association, obtained an outturn of 28½ maunds (2,340 lbs.) of *deswal* jute, 210 maunds of Australian potatoes per acre and Babu Atul Chandra Roy, another member, obtained 260 maunds (9½ tons) of Darjeeling potatoes per acre. Central Province *aus* paddy was tried by the Kushtia, Chuadanga and Meherpur Branch Associations, but the outturns were not satisfactory in the first two places. No work was done by the members of the Jessore Association. The private farm at Murali in Jessore is reported to have done good work. The Khulna Association carried out some demonstration

work in its garden at Sadar and distributed *dhaincha* seed to the cultivators. Babu Trailokya Nath Chatterji of Ghatbhoge in Khulna, by way of popularising potato cultivation, supplied more than 20 cultivators with potato seed and the results were on the whole satisfactory. The Murshidabad Association made an attempt to induce the members to advance the necessary capital for the purchase of bonemeal for distribution among the cultivators, realising the cost from them after the crop was reaped. The Hon'ble Maharaja Ranajit Singh of Nashipur and Babu Nilmony Bhattacharya were the only members who advanced money for the above purpose. Though no important demonstration work was carried out by the members during the year, they appear to have shown a genuine interest in the work of the association. Babu Jogesh Chandra Sen, a member of this association, was very successful in growing English peas. The Manager of the Joypur Government Estate distributed seeds of Nainital potato, *gandari* (sugarcane) cuttings and bonemeal to the Khas Mahal tenants. The outturns of potatoes and paddy with the application of bonemeal was far better than in the previous year. The principal work of the Malda Association was the distribution of bonemeal and *dhaincha* seed for green-manuring purposes to cultivators. The Rangpur Association distributed several maunds of seed manures and a large number of Meston ploughs in the district. Most of the demonstration work in the district was carried out through the agency of this association. Babu Bidhu Bhusan Mukerji of Tushbandar obtained 216 maunds (about 8 tons) of potatoes per acre.

17. **Agricultural Shows and Fairs:**—Eighteen agricultural shows were held during the year under report, as compared with 22 in the previous year. The total contribution made by the Department to these shows amounted to Rs. 3,300. They were all organized by local effort and were generally partly industrial as well as agricultural. At the Darjeeling show held in October 1913 and at the Suri show held in February 1914 special attention was devoted to cattle. The Kurseong show held in April 1914 was devoted to flowers, vegetables and fruit. At all the shows officers of the Agricultural Department attended and showed departmental exhibits. Officers from the Fishery Department also attended at several of the exhibitions and gave demonstrations in curing fish. The Mycological and Entomological Collectors gave lectures on the diseases of crops and the life histories of the various crop pests.

A recommendation was made by the Provincial Agricultural Association, which has been communicated to District Officers, that agricultural exhibitions should be held, as far as possible, in rural areas, so as to be within easy reach of cultivators. One danger of such exhibitions is that effort should be directed chiefly to amusing the public by theatrical entertainments rather than to stimulate an interest in agriculture. On the other hand, if some attention is not given to amusing the people, it is likely that attendance will fall off. Many who come to be amused, see, before they go away, the agricultural exhibits and listen to the lectures of the officers of the department. However, the idea to hold these exhibitions as far as possible in rural areas appears to be sound and will be carried out, as far as possible, in future.

CHAPTER V.

PUBLICATION OF AGRICULTURAL INFORMATION AND SUPPLY OF SEEDS, MANURES AND IMPLEMENTS.

18. The following leaflets, bulletins and reports were published by the department in the course of the year :—

(1) *Leaflet No. 2 of 1913.*—Potato disease and Bordeaux mixture—its preventive measure.
(2) *Leaflet No. 3 of 1913.*—Insect pests and general measures for prevention and remedy.
(3) *Leaflet No. 1 of 1914.*—The large brown cockroach.

(4) *Bulletin No. 1 of 1913.*—Agricultural sayings in Bengal (with analogous sayings in Bihar and Orissa).
(5) Season and Crop Report for 1912-13.
(6) Annual Report of the Department of Agriculture, Bengal, for the year ending 30th June 1913.
(7) Annual Report of Agricultural stations for 1912-13.
(8) Annual Report of the Kalimpong Demonstration Farm for 1912-13.
(9) Bengali translation of Howard's paper on the Improvement of yield and quality of wheat in India.
(10) Bengali translation of Dr. Butler's pamphlet on the *ufra* disease of rice.
(11) " *Dhaner Poka* " or insect enemies of paddy in Bengali.

The publication of the quarterly journal has been taken up by the Agricultural Department of Bihar and Orissa, and " *Krishi Samachar* " or year book of the department, which used to be published by the Agricultural Department of the late Government of Eastern Bengal and Assam, has been taken up by this department. The issue for the Bengali era 1320 has been published.

The Fishery branch of this department published the following two bulletins during the year under review :—

(1) *Bulletin No. 3 (1913).*—On the culture of certain voracious fish in tanks.
(2) *Bulletin No. 4.*—Some remarks on fishery questions in Bengal.

In addition to the above, the Deputy Director of Fisheries prepared the following two papers containing information of a scientific nature only :—

(1) Thirteen larval parasites from the mesenteries of marine fish. (Published in Rec., Ind. Mus., Vol. 9, Pt. V, No. 19.)
(2) A short account of our present knowledge of the Cestode fauna of British India and Ceylon. The paper was read by Mr. Southwell before the first Indian Science Congress at the Centenary Celebrations of the Indian Museum. (Published by the Asiatic Society of Bengal.)

SUPPLY OF SEEDS, etc.

19. During the year 1913-14, April—March, the following seeds, manures and implements were distributed from this department's seed-store at Sibpur.

SIBPUR SEED-STORE.

Seeds	...	392 maunds (14½ tons) of which 176 maunds (6½ tons) *dhaincha* and 41 maunds (1½ tons) paddy.
Manures ...	...	823 maunds (30 tons) of which 343¼ maunds (12½ tons) bonemeal and 421½ maunds (15½ tons) castor cake.
Implements ...	...	15

Of the seeds, a large quantity of *dhaincha* was sent to Madras, while of the manures only bonemeal was distributed to cultivators, the remainder being sent to the Government farms in Bengal.

The following statement shows the receipts and expenditure at the Sibpur seed-store during the financial year 1913-14 :—

	Receipts.	Expenditure (including establishment).
	Rs. A. P.	Rs. A. P.
Sibpur	2,167 13 0	5,797 6 3

The outstanding bills on the 1st April last amounted to Rs. 707-12-9; and manures to the value of about Rs. 1,500 were in stock.

The question of removing the seed-store from Sibpur or of abolishing it altogether is still under the consideration of this department. A proposal has, however, been submitted to Government for the establishment of a seed-store in each division and the fate of the existing seed-store will be decided when the Government order on the above proposal is received.

CHAPTER VI.

MISCELLANEOUS.

20. **Arboriculture.**—Under the existing arrangement, District Boards have prepared decennial schemes of arboricultural work. Each District Board sends a report to the Director of Agriculture through the Public Works Department of the work that has been done during the year. In the course of the year new forms of returns were introduced in consultation with the Public Works Department. In these returns the amount spent by each Board during the year, the income derived and the number of tress planted during the course of the year are reported.

We lost the services of Mr. Proudlock in the course of the year and the control which it is the duty of the Agricultural Department to exercise is now exercised mainly through the Supervisors. The reports from District Boards are received by the department very irregularly. The district which derives the largest amount of revenue from arboricultural sources is the district of Nadia. The expenditure during the year in that district was Rs. 2,348 and the income derived was as much as Rs. 1,434.

21. **Weaving Operations.**—Mr. N. N. Pillai, the Weaving Master, has submitted an interesting account of his work during the year. He has been successful in introducing a very important mechanical improvement in the silk-reeling machine. In the case of the machine which is in ordinary use, a sliding motion is communicated to the guide shaft by means of wooden tooth-wheels. This motion is not continuous in a straight line; and in consequence, the fine strands of thread are subjected to sudden jerks, which occasionally break the thread. There is another drawback, viz., that the teeth of the wooden wheels wear out quickly and have to be frequently repaired. In the new arrangement which Mr. Pillai has introduced, the sliding motion is communicated to the guide shaft not by means of toothed wheels but by pulleys which revolve on an endless rope. Further, the left side of the guide shaft moves in a fixed support in the same manner as on the right side. The motion is therefore continuous and in a straight line. In consequence the strain to which the strands are subjected is not very great and the number of breakages is therefore small. The merits of the new machine have been readily appreciated by the Malda reelers and the machine is being gradually taken up by them. One of the machines was set up as a model in the local weaving school at Malda, where it can be inspected by any one who cares to do so.

Mr. Pillai also demonstrated in a number of places throughout the province the use of the automatic fly-shuttle loom. He also introduced an improved spinning and doubling machine at Mymensingh.

Little progress can be effected in the introduction of these machines, without the formation of weavers' co-operative credit societies. These societies are necessary not only in connection with the purchase of improved implements but also in connection with the purchase of raw material. Mr. Pillai has been engaged for some time, in consultation with the Registrar of Co-operative Credit Societies, in organizing new Weavers' Societies. New societies have been organized at Bhanga, Paschimshadardi and Idilpur and arrangements have been made to start similar societies at Rajbari, Burirhat and Nurpur.

22. **Rainfall.**—During the year under report the total number of rainfall stations in the province was 226. No new stations were opened or any existing ones closed during the year.

*

The statement below gives the number of rainfall stations in each district and the number inspected during the year :—

District.	Number of rain gauge stations.	Number of rain gauge stations inspected.	District.	Number of rain gauge stations.	Number of rain gauge stations inspected.
24-Parganas ...	9	...	Rangpur ...	9	4
Nadia ...	6	...	Bogra	5	...
Murshidabad ...	10	3	Pabna	4	2
Jessore ...	5	...	Malda	6	3
Khulna ...	12	4	Dacca	8	...
Burdwan ...	8	...	Mymensinhg ...	11	6
Birbhum ...	6	1	Faridpur ...	10	...
Bankura ...	10	8	Bakarganj ...	8	3
Midnapore ...	27	...	Chittagong ...	7	...
Hooghly ...	3	...	Tippera ...	8	...
Howrah ...	4	...	Noakhali ...	7	...
Rajshahi ...	7	...	Chittagong Hill Tracts.	3	2
Dinajpur ...	13	3			
Jalpaiguri ...	8	...	Hill Tippera ...	1	...
Darjeeling ...	6	2	Cooch Behar ...	5	2

23. **Agricultural Implements.**—A list of the agricultural implements and machines reported to have been tested in the province during the year is given in Appendix II.

24. **Seed Rates.**—The Agricultural Supervisors were instructed to enquire into the local seed rates in the Presidency. The statement below gives the results of their inquiries. It gives results for Eastern Bengal only. The enquiry will be continued during this year in the other districts of the province :—

Statement showing seed rates per acre.

Name of seed.	Jute.	Aus paddy	Aman paddy.		Boro paddy.	Wheat.	Potato.
			Broadcast.	Transplanted.			
	lbs.	lbs	lbs.	lbs.	lbs.	lbs.	lbs.
Dacca	6 to 14	72 to 90	72 to 90	72 to 90	36 to 46	60 to 72	960 to 1,200
Faridpur	9 to 12	90	90	90	.....	.....	.....
Bakarganj	10	40 to 60	.....	32	70	.....	.....
Mymensingh ...	8 to 12	60	50	50	.....	.....	800
Rajshahi	6 to 10	48 to 120	60 to 120	54 to 90	60 to 72	.....	.....
Malda	6 to 9	72 to 90	60 to 90	60 to 90	48 to 90	.....	.....
Bogra	6 to 9	60 to 72	72 to 90	60 to 90	60 to 72	.....	.....
Pabna	6 to 9	60 to 90	48 to 72	48 to 72	48 to 60	.....	.....
Dinajpur	6 to 9	48 to 90	60 to 90	60 to 90	.....	.....	.....
Jalpaiguri	6 to 9	60 to 72	60 to 90	60 to 90	.....	.....	.....
Rangpur ...	(Early 6) (Late 10)	Coarse 50 to 60 Fine 36 to 42	....	Early 20 to 24 Late 30 to 40	....	20	480 to 640
Tippera ...	7 to 14	64 to 110	54 to 80	24 to 60	32 to 60	.....	.....
Noakhali	7½ to 14	60 to 102	50 to 114	44 to 64	.....	.....	.....
Chittagong ...	.....	64 to 114	60 to 80	40 to 64	.....	.....	.....

25. **General.**—This department has many critics; but it is claimed that a certain amount of advance has been made during the past year. The department has been much hampered in the past for want of an adequate staff; but that difficulty is gradually being remedied. It will take some years to work up to a complete staff. The published results of demonstrations prove that satisfactory work has been done in this connection in Eastern Bengal.

The method of preparing the jute forecast is reaching an increasing degree of accuracy both in the estimate of acreage under the crop and in the calculation of the average outturn per acre in different areas. The sericultural scheme for supplying seed cocoons to rearers free from disease is being gradually worked up and the Rangpur Dairy Scheme is showing considerable promise. Of course immediate results cannot be expected from the latter scheme; and it is unreasonable to complain because immediate results are not forthcoming. The important point for consideration is whether the foundation principles of the scheme are sound. It is believed that in a few years, both from the point of view of producing superior indigenous cattle and also from the point of view of revenue derivable from the farm, the scheme will fulfil the hopes which have been formed regarding it.

The problem of utilizing co-operative credit societies for furthering the work of the Agricultural Department has received increased attention during the year. Co-operative credit societies cannot be utilized for the purpose of furthering demonstration work, until the Agricultural Department has first of all established the success of a particular demonstration in a particular area. It is for this reason that much the greatest difficulty is experienced at the initial stages. When once, however, the success of a demonstration has been established in any given area, the work of utilizing co-operative credit societies for the further spread of the demonstration becomes easy. Progress is being made in bringing the Co-operative Credit Department into touch with the Fishery and Weaving branches of this department. We are only just beginning this work; but it is hoped that, now that a start has been made, considerable progress will be effected before long.

It is intended during the coming year to grow in the Agricultural Farms a considerable quantity of the jute seed, which Mr. Finlow has been engaged in evolving for several years past. If it is proved that the seed has a marked superiority in any particular area, it is proposed to start seed farms on the model of those which have been introduced in the Central Provinces. The results which have been obtained from the system of what is known as " plant to plant selection " are so far very promising and it is proposed to continue this line of demonstration. Another important line of demonstration in the future will be the distribution of cuttings of superior varieties of sugar-cane.

APPENDIX I.

Agricultural Shows and Fairs.

Serial No.	NAME OF FAIR AND LOCALITY.	Dates on which the exhibition was held.	Amount contributed by the Agricultural Department.	Officers of the Department who attended or helped in the Agricultural shows.	Exhibits sent and demonstrations given by the Department.
1	2	3	4	5	6
			Rs.		
	PRESIDENCY DIVISION.				
1	Agricultural and Industrial Exhibition, Bongong (Jessore).	6th to 8th March 1914.	300	Divisional Agricultural Inspector and Travelling Inspector.	Departmental exhibits; demonstrations in the use of chain pumps and *dōn*; ploughing with Meston ploughs; *gur*-making, magic-lantern lectures on insect pests and crop cultivation.
2	Agricultural and Industrial Exhibition, Jhenida (Jessore).	12th to 14th February 1914.	200	Deputy Director of Agriculture, Bengal, and Divisional Agricultural Inspector.	Departmental exhibits; demonstrations in chain pumps, *dōn*, Meston and Hindustan ploughs. Also lectures.
3	Coronation Exhibition, Khulna.	3rd to 10th February 1914.	500	Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations in pumping cane-mills, ploughing. Also magic-lantern lectures on insect pests and crop cultivation.
4	Industrial and Agricultural Exhibition, Baraset (24-Parganas).	1st to 4th February 1914.	200	Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations in use of chain pump and *dōn*; ploughing with Meston ploughs; *gur*-making. Also magic-lantern lectures on insect pests and crop cultivation.
5	Agricultural and Industrial Exhibition, Meherpur (Nadia).	15th to 21st February 1914.	300	Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations in irrigation by pumps and *dōns*; *gur*-making and ploughing.
6	Industrial and Agricultural Exhibition, Banjetia (Murshidabad).	19th February 1914.	300	Deputy Director of Agriculture and Travelling Inspector.	Departmental exhibits; demonstrations in irrigation with chain pump and *dōn*; *gur*-making; ploughing by Meston ploughs. Also magic-lantern lectures on insect pests and crop cultivation.
7	Panchthupi-Kesherpahar Agricultural Exhibition, Kandi Subdivision (Murshidabad).	8th to 14th February 1914	Nil	Officiating Superintendent, Seed Store, Sibpur.	Departmental exhibits; demonstrations in the use of chain pumps, *dōn* and Meston ploughs. Also lectures on crop cultivation.
	RAJSHAHI DIVISION.				
8	Cattle and Agricultural Show, Darjeeling.	9th January 1914.	400	Agricultural Supervisor, Dacca Division.	Fodder and dairy exhibits; demonstration in cream separation, butter churning and cheese-making.
9	Flower and Vegetable Show, Kurseong (Darjeeling).	13th April 1914	100	Travelling Inspector ...	Departmental exhibits; demonstrations in the use of the maize-huller. Also magic-lantern lectures on insect pests and crop cultivation.
10	Kalimpong *Melâ* (Darjeeling).	26th and 27th November 1913.	...	Ditto ...	Departmental exhibit.

Serial No.	NAME OF FAIR AND LOCALITY.	Dates on which the exhibition was held.	Amount contributed by the Agricultural Department.	Officers of the Department who attended or helped in the agricultural shows.	Exhibits sent and demonstration given by the Department.
1	2	3	4	5	6
			Rs.		
11	Agricultural Exhibition, Chaulia, Serajgunge (Pabna).	24th to 27th February 1914.	100	Deputy Director of Agriculture and Divisional Agricultural Supervisor.	
12	Agricultural Exhibition, Falakata (Jalpaiguri).	31st January to 15th February 1914.	...	Agricultural Supervisor, Rajshahi Division.	Departmental exhibits.
	BURDWAN DIVISION.				
13	Cattle and Produce Show, Suri (Birbhum).	6th to 11th February 1914.	300	Deputy Director of Agriculture and Superintendent, Chinsura Farm.	Departmental exhibits; demonstrations in pumping, *gur*-making and ploughing.
14	Agricultural and Industrial Exhibition, Uttarpara (Hooghly).	Xmas holidays	...	.....	... ..
	DACCA DIVISION.				
15	Agricultural Show char Janajat (Faridpur).	7th February 1914.	200	District Agricultural Officer, Mymensingh.	Departmental exhibits; demonstrations in Meston plough, Planet Junior hand-hoe. Also magic-lantern lectures.
16	Agricultural Show, Madaripur (Faridpur).	26th January 1914.	...	Travelling Inspector ...	Demonstrations in the use of Meston plough and Planet Junior hand-hoe.
17	Kamararchar Agricultural Exhibition (Mymensingh).	28th and 29th February 1914.	300	Divisional Agricultural Supervisor and the District Agricultural Officer, Mymensingh.	Departmental exhibits; demonstrations in Meston plough, Planet Junior hand-hoe, magic-lantern lectures and also lectures on improved agricultural methods.
	CHITTAGONG DIVISION.				
18	Agricultural Exhibition, Brahmanbaria (Tippera).	9th to 23rd February 1914.	100	Divisional Agricultural Supervisor.	Departmental exhibits.

APPENDIX II.

A List of Agricultural implements and machines tested in Bengal during the year ending 30th June 1914 and of those in use which are reported to have met with success.

No.	Designation of implements.	Use.	Special advantage or instruction.	Price.	Where procurable.	Name and designation of reporting officer.	Opinion.	Extent to which used by agriculturists.
1	2	3	4	5	6	7	8	9
				Rs. A.				
1	Meston plough ...	Ploughing lands ...	More effective than country ploughs and makes deeper furrows.	6 8	Messrs. Burn & Co., Howrah.	T. N. Chatarji, member, District Agricultural Association, Khulna, Baikuntha Chandra Sen, manager, Bamandanga estate, Rampur; Secretaries, District Agricultural Association, Bankura and Birbhum; N. N. Gupta, Esq., Agricultural Supervisor, Rajshahi Division, and others.	Very useful on light oil.	Its use is being steadily extended among the cultivators.
2	"Planet, Junior" Hand Hoe.	Hoeing and weeding plants.	Very useful for making ridges.	16 0	Ditto ...	Rai Saheb B. C. Mazumdar, Secretary, District Agricultural Association, Khulna. N. N. Gupta, Agricultural supervisor, Rajshahi Division.	Specially useful in the cultivation of crops sown in rows.	Used to a limited extent.
3	"Amfan" Grinding Mill.	Crushing grains for cattle-food.	Specially useful when a large number of cattle has to be fed.	90 0	Ditto ...	J. N. Chakrabarty, Superintendent, Rangpur Dairy Farm.	Satisfactory ...	Not used by the cultivators on account of high price.
	D. B. Chaff-Cutter...	Cutting fodder for cattle.	Ditto ...	100 0 to 120 0	Ditto ...	Ditto ...	Quite good	Ditto.
5	Chain Pump ...	Pumping water for irrigation.	A very simple contrivance for drawing water from tanks. The machine can be repaired by the local blacksmith when out of order.	60 0	Ditto ...	K. Roy, Esq., Member, District Agricultural Association, Khulna.	Very useful ...	Much appreciated by the cultivators, but used to a limited extent on account of its high price.
6	Knapsack's sprayer	For spraying insecticides and fungicides to plants.	.....	60 0	Messrs. T. E. Thomson & Co.	Ditto ...	Ditto	Used to a large extent by the tea planters.
7	Hand Hoe or Hand cultivator.	Used for making furrows and ridges also used for weeding.	It saves time and labour. Specially useful in gardening and in the cultivation of crops sown in rows.	5 0	Messrs. Burn & Co.	T. N. Chatterji, Esq., Member, District Agricultural Association, Khulna.	Ditto	Not used by the ordinary cultivators.
8	Spraying pump ...	Used for spraying to prevent plant disease and insect attacks.	A very simple and effective contrivance.	35 0 to 42 0	Agricultural Farm, Rangpur.	Romesh Chandra Das, General Manager, Court of Wards Estate, Rangpur.	Ditto	Being demonstrated.

B. S. Press—20-11-1914—2409J—560—H. C

REVENUE DEPARTMENT.

AGRICULTURE.

CALCUTTA, THE 11TH JANUARY 1915.

RESOLUTION—No. 330Agril.

READ—

The Report of the Department of Agriculture, Bengal, for the year ending the 30th June 1914.

Staff.—Mr. J. R. Blackwood was in charge of the Department throughout the year. Mr. A. A. Meggitt, as Agricultural Chemist, worked both in this province and in Assam until January 1914, when his services were placed entirely at the disposal of the Assam Administration, and Mr. H. E. Annett was appointed Agricultural Chemist in Bengal. Mr. G. P. Hector held the post of Economic Botanist and Mr. F. Smith that of Deputy Director of Agriculture. Mr. R. S. Finlow was absent on leave during the year, and his work was carried on, so far as possible, by the Economic Botanist and the Agricultural Chemist jointly in addition to their own duties.

The appointment of a second Deputy Director of Agriculture for Bengal was sanctioned during the year, and the officer selected for the post is now undergoing a preliminary course of training at the Imperial Research Institute at Pusa. Since the close of the year the formation of a regular cadre for the Provincial and Subordinate Agricultural Services has been sanctioned. It is not possible at present to draw up a final scheme for the different services, but the sanctioned cadre now makes provision for immediate requirements and will be capable of expansion as the work develops. The Provincial Service consists of six posts of Agricultural Superintendents on Rs. 200—10—400, thus enabling a Superintendent to be posted to each of the five divisions, while the services of another will be available for special enquiries. The Subordinate Service has been divided into two classes, namely, class I on Rs. 100—5—200 and class II on Rs. 50—2½—100. Class I includes the Farm Superintendents and the Travelling Inspectors of the Department and class II, the District Agricultural Officers now employed in Mymensingh and Rangpur and the Mycological and Entomological Collectors. The qualification required for the Provincial Service will for the present be a training in agriculture in Europe, America or Japan, and class I of the Subordinate Service will be reserved for men holding a degree or certificate from an agricultural college in India.

2. *Agricultural Education.*—Eighteen students from Bengal attended the Agricultural College at Sabour in Bihar and Orissa during the year. Eleven of them obtained the College diploma on completing the course, and it is reported that most of these men have succeeded in obtaining appointments. Little use is made, except by candidates for Government employment, of the special facilities offered to students from Bengal to enter the College, but a desire is frequently expressed that provision should be made for some form of agricultural training in this Presidency. The Governor in Council has accordingly caused a scheme to be drawn up for giving a short course of practical training in scientific agriculture on the Dacca Farm, which is the most important agricultural station in the Province and is the head-quarters of the Agricultural Chemist, the Economic Botanist and the Fibre Expert. The scheme is not intended to qualify students for Government employment, but simply to provide the sons of landholders and other

gentlemen with a knowledge of the elements of agricultural science and of improved methods of cultivation, which they could put to practical use in the management of their estates. The opinion of the leading landholders' associations has been invited on the general suitability of the scheme and on certain details connected with it.

The system of training apprentices on farms is being extended, and it has been decided that appointments as fieldmen demonstrators will in future be given only to persons who have undergone a systematic course of training under arrangements which have been tentatively sanctioned.

The report on the results of the "Nature Study", which forms part of the curriculum of primary schools, is again unsatisfactory, and it seems clear that, mainly owing to the lack of qualified and capable teachers, little practical good is being effected. The Governor in Council would be glad if the Director of Public Instruction would go into the whole question in consultation with the Director of Agriculture and consider what action can be taken to place matters on a better footing.

3. *Research and Experiments at Agricultural Stations.*—It has been decided that in future the reports of the scientific officers of the Department and of the work done at the agricultural stations will be published in a separate volume, a general summary being given in the Director's report, which deals with the work of the department as a whole. The experimental and research operations at the Dacca Farm are beginning to yield interesting results, which, it is hoped, will be of practical, as well as of scientific value. Mr. Hector, the Economic Botanist, has now studied in detail for three seasons the characters of over 200 types of transplanted *aman* paddy and has isolated the best for a practical test in the fields. He has also made some interesting experiments in the methods followed in Japan for separating light from heavy seed by immersion in a solution of common salt, which causes the light seed to float on the surface, while the heavy seed sinks to the bottom. This simple system of seed selection should prove useful to the Bengal raiyat, who, as the Director observes, is apt to use very bad seed and too much of it. Experimental work for the eradication of the *ufra* disease was continued during the cold weather of 1912-13 in certain areas in Dacca and Noakhali, where the disease had been very prevalent in the previous season, but fortunately there was no outbreak of the disease in 1913, and the results obtained were, therefore, necessarily inconclusive. The Governor in Council is glad to see that the operations are being continued in consultation with Dr. Butler of Pusa, whose valuable monograph on the subject of the *ufra* disease has been translated into Bengali and should be circulated as widely as possible. Mr. Finlow's work on fibres was to a great extent interrupted owing to his absence on leave, but a considerable quantity of superior jute seed, selected on the pure line culture system, is now available, and arrangements have been made to give it an extensive trial on a practical scale during the coming season. The manurial experiments, which were begun in 1911 in connection with the effects of lime and phosphates on red soil were continued on the Dacca Farm, and it appears to have been definitely established that the application of these manures creates an immediate improvement. The Governor in Council is glad to see that arrangements are being made to demonstrate the results in tracts with similar soils. Mr. Annett, the recently-appointed Agricultural Chemist, has drawn up a full and interesting programme of work, embracing an important analysis of the juices of the various varieties of sugarcane grown on the Dacca Farm, and a study of the methods employed for the extraction and manufacture of sugar from the date palm, which, it is hoped, will lead to the discovery of improvements and assist the re-establishment of the industry. Mr. Annett has also taken up the important question of a soil survey of the province, as well as investigations of the contents of manures, food-stuffs and the root nodules of leguminous plants.

On the minor farms experimental work has been carried out mainly in connection with rice and jute, but it is not clear how far the operations have been co-ordinated with those at the main agricultural station at Dacca. This matter should be borne in mind in connection with the redistribution of

work, which will be necessary on the arrival of the second Deputy Director whose head-quarters will be on the Dacca Farm.

4. *The Rangpur Dairy Farm*—Possession of all the land acquired for this farm was not obtained until November 1913, and it is not therefore as yet possible to come to any conclusion as to the measure of success likely to be attained by the farm in fulfilling its main function of solving the difficult problems connected with the breeding and maintenance of cattle in a highly-cultivated tract. Great difficulty has been experienced in securing suitable cows, and the number of cattle so far obtained is little more than half of that which the farm could maintain. Further experience is necessary before a definite cropping scheme can be framed, and some time must elapse before the effects on the cattle of judicious breeding and selection, combined with careful and liberal feeding, can be ascertained. So far the local demand for the milk produced on the farm greatly exceeds the supply.

5. *Demonstration Work.*—Good progress has been made in organising and developing the demonstration work of the Department. The reconstitution of the Provincial and Subordinate Services and the scheme for the training of demonstrators have already been described. Demonstrations in the use of bonemeal manure have been continued in various districts of Eastern Bengal and have achieved a considerable measure of success, increases of outurn, yielding a substantial net profit, having been obtained in the majority of cases. When the scheme was first started it was found necessary to invoke the assistance of the zamindars to purchase bonemeal for their raiyats, but it is now reported that the intervention of the zamindars is no longer required, as the raiyats are sufficiently convinced of the advantages of bonemeal to purchase it for themselves. In some cases co-operative societies have assisted their members to purchase bonemeal. Two societies have been formed for this purpose in Dacca, and the co-operative societies in Mymensingh and Faridpur are financing their members for the purchase of seed and manures. There seems now to be scope for a further extension of the usefulness of the co-operative agency in popularising agricultural improvements. It is of course essential that co-operative societies should not be used for the purpose of financing experiments, but once the suitability of an improvement to a particular area has been established, the societies should be able to render valuable assistance in accelerating its introduction. The Director of Agriculture should keep in close touch with the Registrar of Co-operative Societies in regard to this matter.

Among other successful demonstrations may be mentioned those in connection with superior varieties of potato, and measures for the conservation of cowdung in pits. Further efforts were made to induce the cultivators to take more trouble with the selection of their jute and paddy seed, by reserving the best plants for this purpose. It is stated that the actual selection was made in all cases in the presence, and with the advice, of the Supervisor or District Agricultural Officer, and the results obtained from the use of the seed so selected have been very favourable in nearly every case. It will be interesting to see next season how far the system has impressed the neighbouring cultivators as a feasible means of increasing their profits. It has been objected on good authority that the methods adopted are not sufficiently precise or scientific to produce any permanent improvement, and that it would be impossible to provide the necessary supervision if the system became general among the raiyats. The Governor in Council fully realises the force of these objections, but there can be no harm, and there is a possibility of much good, in teaching the raiyat that he can secure an increased outturn, with little or no extra trouble or expense to himself, by paying more attention to the selection of plants for seed, instead of taking any plants haphazard for the purpose, or even, as often happens in the case of jute, deliberately selling the best plants for fibre and reserving only the inferior ones for seed. There is nothing in the scheme to interfere with the more careful and scientific methods of seed selection followed by the scientific officers of the Department. On the contrary, if Mr. Blackwood's operations lead the raiyats to appreciate the importance of

using good seed, they will be the more ready to take advantage of superior seed, when the Department is in a position to place it within their reach.

6. *Sericulture.*—It was mentioned in the resolution on last year's report that M. Lafont, the French Sericultural Expert, was compelled to leave India on account of illness and that another expert, M. Grangeon, who had had experience of silk work in Madagascar, had been appointed in his place. After his return to France, M. Lafont submitted a report on his work in India, which was published in the course of the year. It appears that the attempt to convert univoltine races of silk-worms into polyvoltine by acclimatisation was a failure in Bengal, although it had succeeded in Madagascar. In regard to the experiments in cross-breeding, it has been proved that, although cross-bred worms are superior in the first generation to the indigenous varieties, they rapidly deteriorate afterwards as they cannot stand the climate of Bengal, especially during the period from July to October. To get over this difficulty, M. Grangeon has proposed to keep the seed cocoons in the hills during that period, and a small nursery has been established experimentally at Kurseong. M. Grangeon has been called away for duty with the French army and his work is now being carried on by Mr. P. C. Chaudhuri. Further progress has been made with the scheme for the establishment of central nurseries from which pure seed cocoons, free from disease, will be supplied under Government supervision. The opening of nurseries in Malda and Bogra has rendered possible an important advance by enabling nurseries to obtain their seed cocoons by exchange with one another, instead of, as formerly, by purchase from village rearers.

It is satisfactory to find that a student of the Sericultural class, attached to the Berhampore Central Nursery, after having passed the final examination, has built a model nursery and has commenced rearing on scientific lines. It is hoped that the visit paid by the Superintendent of Sericulture to the Punjab, the United Provinces, Bombay and Nagpur during the year with the object of bringing purchasers of silk into direct contact with the silk-reelers of this province will produce good results.

7. *Fisheries.*—Mr. Southwell, the Deputy Director of Fisheries, has submitted an elaborate and interesting account of his work during the year. The main problem before the Department is to increase the fish supply of the province either by tapping new sources of supply or by improving existing sources, and this object is being kept steadily in view in the scientific investigations which form a necessary preliminary to economic work. The statistical enquiry regarding the fish trade of the province has been completed, and Mr. Southwell has worked out and published an important scheme for the introduction of trawling on commercial lines in the Bay of Bengal. A similar scheme for opening out the Sundarbans fisheries is being prepared. The investigation of the breeding conditions of *hilsa* has been continued, but is hampered by the want of a launch, the building of which has been delayed owing to various difficulties. Some important experimental work has been done in connection with the destruction of carp in tanks by predaceous fish, and a large quantity of fry has been supplied under special arrangements with the Railway Companies. A fishermen's co-operative society has already been started in Bakarganj, and it is hoped that additional societies will shortly be started at other places in Eastern Bengal, with the object of assisting fishermen to obtain cheaply nets, boats and other implements of their calling and to enable them to dispose of their catches at reasonable prices. Propaganda work, including instruction in such matters as the stocking of tanks, the curing and transport of fish and the care of fry, has everywhere been very successful. Mr. Southwell reports that the time is now ripe for undertaking more extensive work both of a scientific and economic nature, and the Governor in Council trusts that it will be possible by means of sound and practical schemes to effect some definite improvements in an industry which is of vital importance to the people of this Presidency.

8. *The Jute Forecast.*—The method of preparing the jute forecast was further considered during the year in consultation with the Jute Forecasts Committee of the Bengal Chamber of Commerce. A somewhat elaborate scheme for ascertaining and recording annually the exact area

under jute was drawn up at the request of the trade and published for criticism, but was eventually abandoned with the concurrence of the various sections of the trade, both on account of the heavy expenditure involved and also because of the worry and trouble which it was likely to cause to the jute cultivators. The London Jute Association expressed the view that the recent jute forecasts have been as approximately accurate as it is reasonable to expect, and the general opinion appeared to be that the present system of basing the forecast on a detailed census made by the panchayats of the jute cultivators in each union should be continued. The Governor in Council has accordingly decided to adopt this course for the present, though no effort will be spared to improve the system so far as funds and staff permit.

9. Though no striking economic success has been achieved or is in prospect, the record of the work of the Bengal Agricultural Department during the year is one of progress. The scientific operations, particularly those relating to seed selection, have now reached a stage at which they can be submitted to a practical test of their economic value, and when the recently sanctioned increase of the staff has had time to take effect, it should be possible to organise the demonstration work of the Department on sound and practical lines. The Department has no reason to complain of lack of interest or lack of criticism on the part of the public, and His Excellency in Council has no doubt that once it has been able to make its aims and objects understood by successful and practical demonstration of the results achieved, it will secure a full measure of appreciation and gratitude.

By order of the Governor in Council,

J. H. KERR,
Secretary to the Govt. of Bengal.

No. 446.

Copy forwarded to the Director of Agriculture, Bengal, for information, with special reference to paragraphs 2 and 5 of the Resolution.

No. 447.

Copy forwarded to the Registrar, Co-operative Societies, Bengal, for information, with special reference to paragraph 5 of the Resolution.

No. 448.

Copy forwarded to the Director of Public Instruction, Bengal, for information and for favour of necessary action with reference to paragraph 2 of the Resolution.

2. He is requested to inform Government of the action which he might decide to take, in consultation with the Director of Agriculture, Bengal, to place matters on a better footing in regard to "Nature study" in primary schools.

By order of t Governor in Council.

J. N. MITRA,
Under-Secy. to the Govt. of Bengal.

Calcutta,
The 11th January 1915.

B. S. Press—22-1-1915—5324C—799—B. N. K.

REPORT

OF THE

AGRICULTURAL DEPARTMENT,

BENGAL,

FOR THE

YEAR ENDING 30TH JUNE 1915.

BY ORDER OF THE LIEUTENAN
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CALCUTTA:

BENGAL SECRETARIAT BOOK DEPOT.

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Published by the Bengal Secretariat Book Depot,
Writers' Buildings, Calcutta.

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DEPARTMENT OF AGRICULTURE, BENGAL.

No. 8826A.

FROM J. R. BLACKWOOD, ESQ., L.L.B., I.C.S.,
Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

Dated Calcutta, the 29th October 1915.

SIR,

I HAVE the honour to submit the Annual Report of this Department for the year ending 30th June 1915.

The reports of the expert officers have been published separately.

I have the honour to be,
SIR,
Your most obedient servant,
J. R. BLACKWOOD,
Director of Agriculture, Bengal.

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ANNUAL REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

FOR THE

YEAR ENDING 30TH JUNE 1915.

CHAPTER I.

Administration.

THE reports of the Expert Officers have been published *verbatim* as a separate publication of the department, as was done last year.

2. I remained in charge of the department and Mr. D. N. Mookerji continued to act as my Personal Assistant throughout the year. Mr. F. Smith worked as Deputy Director of Agriculture for the whole province up to 29th January last when Mr. Kenneth McLean joined his appointment as 2nd Deputy Director of Agriculture. Mr. McLean had arrived in India on 28th October 1914 and was on three months' training at Pusa. When he joined at Dacca he was placed in charge of the farms in East Bengal (with the exception of the Kalimpong Farm) as well as of demonstration work in the Dacca, Rajshahi and Chittagong Divisions. Mr. Smith, the first Deputy Director of Agriculture, was, after the arrival of Mr. McLean, placed in charge of the demonstration work in the two divisions of West Bengal (viz., Presidency and Burdwan) together with the Agricultural stations at Chinsura, Burdwan and Kalimpong. There was no change in the expert staff at Dacca. Messrs. H. E. Annett and G. P. Hector continued to work as Agricultural Chemist and Economic Botanist respectively throughout the year. Mr. R. S. Finlow returned from combined leave on 29th July 1914 and resumed the duties of Fibre Expert.

In the Provincial Service there is now a Superintendent of Agriculture for each division, each being in charge of the demonstration work in his own jurisdiction. Mr. J. N. Chakravarti was in charge of the Dairy Farm at Rangpur and also exercised general control over the other two Agricultural Farms in the district (viz., the Burirhat Farm and the Rangpur Demonstration Farm) as well as over the demonstration work of the Rangpur district. Babu Rajeswar Das Gupta worked as Superintendent of the Dacca Division and Messrs. N. Gupta and Dwija Das Dutta, who have now been confirmed in their appointments, held charge of the Rajshahi Division (excepting the district of Rangpur) and the Chittagong Division respectively. Messrs. H. P. Mitra and J. N. Sarkar were appointed Superintendents of Agriculture during the year, the former in the Presidency and the latter in the Burdwan Division.

In the Subordinate Service there is a District Agricultural Officer for each of the districts of Dacca, Mymensingh, Faridpur, Bakarganj, Rangpur, Pabna and Malda. Babu S. K. Dutt, formerly Travelling Inspector, has been placed under the Superintendent of the Presidency Division and the services

of Babu Harakumar Guha, formerly Farm Superintendent at Rajshahi, and Mr. P. G. Krishnan, Superintendent of the Central Seed Store at Sibpore, have been placed under the Superintendent of the Burdwan Division as district agricultural officers. A number of apprentices are appointed every year in the agricultural farms under the department, where they are given a year's practical training before they are appointed as Fieldmen demonstrators. There are at present 75 demonstrators in all. With the development of the work of the department, it is proposed ultimately to appoint an agricultural officer for each district and a demonstrator for each thana. The agricultural farms at Chinsura, Dacca and Rajshahi are each under a Farm Superintendent, while an Overseer is in direct charge of each of the farms at Burirhat and Rangpur. Babu P. C. Sen, Babu A. L. Som, and Mr. N. N. Pillai continued to work as Entomological Collector, Mycological Collector and Weaving Master throughout the year under report.

In the Sericultural Department, Babu A. C. Ghose held the post of Superintendent of Sericulture with his head-quarters at Malda. Messrs. M. M. Chakravarti and P. C. Chaudhuri remained in charge of the Mirgunj and Berhampore Central Nurseries respectively. Mr. Grangeon, who was appointed to carry out hybridising experiments in place of Mr. Lafont, left India at the outbreak of the European War to join the French Army, and his work is being carried on by Mr. P. C. Chaudhuri. Miss M. L. Cleghorn has been appointed, under orders of the Government of Bengal, for five years for the present on an allowance of Rs. 5,000 per annum, to carry on cross-breeding experiments which she is now conducting at her Calcutta residence.

In the Fishery Department, Mr. T. Southwell, Deputy Director of Fisheries, remained in charge of the Fishery work for the Provinces of Bengal, Bihar and Orissa. He was assisted by two Superintendents, Messrs. B. Das and S. M. Mohsin. The services of the Zoological Assistants have been extended for another year. A stern-wheel steam launch was built during the year under report for the use of the Deputy Director of Fisheries in order to carry out *hilsa* and *carp* investigations.

3. **Tours.**—I was on tour for 101 days during the year. This represents a short period as compared with that of previous years; but the reason is that a considerable amount of time was taken up with attending volunteer parades and classes which necessitated my being present at head-quarters. Mr. Smith, whose jurisdiction extended over the whole province during the greater part of the year, was 204 days out on tour. He spent the month of December last in visiting the farms of the Madras Presidency. Mr. McLean, the 2nd Deputy Director of Agriculture, remained out of his head-quarters for 99 days. Mr. Southwell's tour in the two provinces of Bengal, Bihar and Orissa extended over a period of 120 days, mostly spent in visiting Buxar and Cuttack in connection with the establishment of *carp* and *hilsa* hatcheries. A portion of his time was also spent on the launch, and he visited Madras on two occasions, once to attend the meeting of the Annual Indian Science Congress and on the other occasion to inspect the canning factories at Calicut and Beypur, the fish-curing yard at Tanur, the trout hatcheries in the Nilgiris as well as the Chank Fisheries of Tuticorin. He also spent 17 days with Dr. Annandale, Superintendent of the Indian Museum, in the Chilka Lake. Mr. Annett spent 97 days on tour. Most of his time was spent in visiting places in connection with the production of sugar from the date palm. He also visited the Madras Presidency in March and April last to examine the students of the Agricultural College at Coimbatore. He made a tour of the palm-sugar producing districts of Madras and visited various factories. Mr. Hector, Economic Botanist, spent 64 days on tour chiefly in visiting the various farms in connection with his work on rice. He also visited Noakhali, Tippera and Bikrampur in connection with experiments for checking the Ufra disease of paddy. The Superintendents of Agriculture spent a large amount of time in touring, most of the time being spent in supervising demonstration work. The Superintendent of Sericulture spent 295 days on tour in inspecting the various central nurseries and looking after the disinfection of the houses of village rearers. The subordinate officers of the department were also frequently on tour in connection with their respective duties.

CHAPTER II.

Agricultural Education.

4. In the absence of an Agricultural College in this Presidency, students from Bengal, who desire a training in Agriculture, attend the Agricultural College at Sabour. The Principal of that college reports that five students appeared at the Diploma examination held in March last, of whom four were successful. Of these two have secured appointments under the Government of Bihar and Orissa as Supernumerary Agriculturists and another has secured a temporary appointment under this department. There were only two Bengal students in the second year class and both of them have now gone up to the third year class. Of the six students admitted to the first year class in the session 1914-15, three left the college and the others were promoted to the second year class. Eight students from this Province have obtained admission to the first year class this session.

One student was sent to Pusa in June 1914 for a course of two years' training in general Agriculture and Economic Botany under the Imperial Expert Staff. He has completed the training in Agriculture and has now taken up the Mycological course. A new scholarship of Rs. 30 per mensem tenable for two years at the Pusa Institute has been sanctioned this year; but it is vacant, the candidate selected having failed to join at the last moment.

Nature study still continues to be part of the curriculum of primary schools. The want of properly trained teachers and of necessary appliances continues to retard progress in this branch of teaching. The matter was discussed at a conference held at Rangpur with the Directorof Public Instruction. Recently some teachers of guru-training and circle schools have returned to their schools after receiving some training in the subject at the Training College, Dacca. Progress in this subject must continue to be gradual.

There is an agricultural class at the Kalimpong Middle School, at which there are two gardens, one for the infant department, in which the pupils grow plants required for object lessons and another which is worked by pupils from the 1st standard upwards. The Manager of the Kalimpong Demonstration Farm gives instruction at the farm to the senior pupils. The school assists in the distribution of selected maize seed among the farmers round about Kalimpong.

The department continues to train a certain number of apprentices in practical agriculture at each of the Government farms. The apprentices are in the meantime usually appointed demonstrators after they have completed their training; but the system provides a useful means of training young men in improved methods of agriculture, even although it may not lead subsequently to a Government appointment.

CHAPTER III.

Research and Experiment.

1.—Agriculture.

5. The reports on the Agricultural Farms have been published, as was done last year, in separate volume *verbatim* along with the reports of the other expert officers of the department. Mr. Smith has written the reports of the Chinsura, Burdwan and Kalimpong Farms, while Mr. McLean has written those of the Dacca, Rajshahi, Burirhat and Rangpur Demonstration and Rangpur Dairy Farms.

In the case of the Chinsura Farm the rainfall during the year under report was very unsatisfactory. There was too much rain in May and July which caused serious damage to jute and paddy seedlings by water-logging. Later on there was a period of drought.

In the variety experiment tried with eight varieties of winter rice, *Indursail* from selected seed of the Economic Botanist gave under the unfavourable conditions of the year a higher outturn (13¼ maunds per acre) than the local coarse variety called *Nagra* (11½ maunds) which has usually done best on the farm. *Badshabhog* and *Samudrabali*, two scented and better priced varieties, seemed to stand the deficiency of late rains very fairly, while *Banktulsi* appeared to suffer the worst. In the case of the seedling experiments there was little to choose between two seedlings and four seedlings planted 8″ and 12″ apart; but those transplanted by the 15th of July gave a very much better outturn than those transplanted a month later—by 15th of August. Mr. Smith remarks that, apart from irrigation nothing can compensate for delay in the transplanting of paddy later than July in the Burdwan Division. Other things being equal, the outturn is always less the later the paddy is transplanted after the middle of July.

In the Kalimpong Farm five varieties of maize, of which the seed had been selected on the farm, were again compared, namely Yellow Round, Yellow Flat, White Round, White Flat and Red Round. The Yellow Round and the White Round are the two best. The outturn of maize was again higher on unterraced than on terraced land. Among the subsidiary crops *Kodo* and Buckwheat also gave a higher outturn on the unterraced slopes, but *Kalai* and Soybeans gave the opposite result. Pineapples did exceedingly well. Peaches fruited properly; but as the trees are of late varieties, the fruits ripening in the rains lacked the colour and bloom that are obtained at Quetta or in the plains. The fruits do very well, however, for cooking. It is proposed to attempt to obtain an early fruiting variety.

In the Burdwan Farm 186 maunds of potatoes per acre were obtained from the Italian variety against 60 maunds from the Nainital variety. *Deshi* jute (*Corchorus olitorius*) gave an outturn of 16 maunds per acre against 14½ maunds of East Bengal jute (*C. Capsularies*). Paddy after jute owing to the drought was a failure. Sugarcane cuttings were supplied to the public to the number of 64,000 of the white Tanna variety and 65,000 of the *Khari* variety.

On the Dacca Farm the seed of *aus* paddy was selected by treating it with a saturated solution of common salt. Only the heavy seed that sank in the solution was sown at the rates of one maund per acre and half a maund per acre. The outturns were 18½ maunds and 13 maunds 12 seers per acre respectively.

Nine varieties of winter paddy were compared. Mr. Hector's *Indursail* is considered to be all round the best, though it did not give the highest outturn. In the spacing and seedling experiments with winter paddy two seedlings gave better results than four seedlings per hole. The distance of the holes themselves, whether 8″ or 12″ apart, made very little difference. What however is really most imporant is that, other conditions remaining the same, the transplantation should take place early. It is a point upon which Mr. Smith also, as we have seen above, lays very strong emphasis.

Burirhat Farm.—Cigarette manufacturers confine themselves to purchasing country tobacco. There is practically no demand for high grade cigarette tobacco. The flue curing operations have, therefore, been suspended for the present. Babu Jamini Kumar Biswas, the former Superintendent, is surveying the "Tobacco belt" of the Rangpur district and has been instructed to collect the seed of such plants of the various local varieties as are especially valued by the Burma buyers. The farm is now in charge of an overseer under Jamini Babu's general supervision. During the year under report about 10 maunds of Sumatra cigar wrappers was sold at an average price of Rs. 60 per maund. The following seeds were supplied to the public :—

	Oz.
Sumatra	31
Turkish	5
White Barley	7
Local	3¼

In the Rangpur Demonstration Farm winter paddy and jute are the most important crops; but during the year under report transplantation of winter

paddy and steeping of jute could not be carried out for want of sufficient rain water. Owing to the drop in the price of jute the area under this crop has been much reduced in the district as indeed in the entire Province this year, and there was very little demand for jute seed.

Rajshahi Farm.—Five varieties of sugarcane were compared, namely, Velna Mukhi, B. 14, Yellow Tanna, Samsara and Khagri. Velna Mukhi gave the highest outturn of 122 maunds of *gur* per acre followed by B. 14 which gave 120 maunds and Tanna which gave 111 maunds of *gur*. The local raiyats, however, are particularly taken with the Tanna variety on account of its upstanding character with no tendency to lodge and also on account of its hardness which prevents damage by wild animals (pigs and jackals). Three varieties of *aus* paddy were compared, one (Keshia Paju) being a local variety and the two others (Larcase and Boaljuri) the heaviest yielders on the Dacca farm. The local variety gave a much larger outturn (24 maunds per acre) than the other two (which gave only 11½ maunds and 15 maunds per acre respectively). Olitorius or *Deshi* jute was grown alongside of Capsularis or East Bengal jute giving an outturn of 19½ and 8⅓ maunds of fibre per acre respectively. An acre and a half was sown with Mr. Finlow's selected seed, but the crop was grown for seed, not for fibre.

The Rangpur Dairy Farm.—The main object of this farm is the improvement of indigenous cattle by selection and crossing with nearly allied species. A number of the best indigenous cows which could be found in the Province were purchased and a careful record kept of their milk yields. The daily average yield of milk per day for each cow varied from 3 lbs. in August 1914 to 4·2 lbs. in May 1915. The best total yields of milk during the lactation period were 2,593, 1,849, 1,423 and 1,244 lbs. These yields were obtained after the calves had been given a sufficient quantity of milk. The problem therefore before us is to work up to a herd which will give on the average 700 seers per annum per cow. It is also necessary to fix on the type of animal, which it is desirable to breed. In the report on the survey and census of cattle in Bengal, which has recently been published, certain approximate measurements of what the ideal animal ought to be have been indicated.

One cow and eighteen calves died during the year and three cows and 45 calves were sold off. The stock in hand on 30th June 1915 was :—

Bulls	2
Bullocks	59
Cows	111
Calves	101

As was stated in last year's Annual Report one of the minor objects of the farm is to demonstrate the possibilities of mixed farming. With the quantity of farm-yard manure produced, good crops should be obtained. The farm depends mainly for its revenue on the sugarcane crop and no appreciable revenue was obtained from that crop during the year under report, as the cane was not laid down in any quantity till the beginning of the year 1914. Next year it is proposed to lay down about 200 bighas under the crop after which it is expected that the farm will prove financially profitable. The cane will be crushed by means of an oil-engine.

2.—Fibres.

6. The Fibre Expert continued his investigations into the question of proper manuring for jute. Particular attention was given to the acid red soils of which the Dacca Farm is a type. It has been found that an application of lime and bone together with cow-dung produces a marked increase not only in the outturn of jute but also of a crop of mustard following it in rotation in the *rabi* season. It seemed doubtful, however, if these manures would have an equally marked effect on the crop in the raiyats' fields, the acid character of which had perhaps been neutralized to some extent by the application year after year of household ashes (containing potash) together with cattle manure. Accordingly, during the present season bonemeal and lime have been applied to some raiyats' fields in the neighbourhood of the farm to see how the crop responds to these manures. The results,

as far as it could be judged from the appearance of the jute plants, which were still standing when Mr. Finlow wrote, were promising. Experiments are also being made on the farm to see to what extent potash is a specific plant food for jute. Phosphatic manures apparently do not increase the height of the jute plants, but they seem to increase the precentage of fibre in the plants.

The raiyat's poverty undoubtedly stands in the way of his buying these expensive chemical manures ; but this obstacle may be overcome by the establishment of Co-operative Credit Societies.

At the beginning of the present season the Fibre Expert had enough seed of his pure line cultures to sow about 1,000 acres ; but owing to the low price of jute last year due to the war there was a great contraction in the area sown this season and the demand for the improved seed was consequently not very keen. In many places, however, his selected seed is being compared with the raiyats' seed ; and if any of the latter is found superior it will receive Mr. Finlow's careful attention. Seed has also been procured from all the jute growing districts and over 700 small plots have been sown with this seed on the Dacca Farm. Mr. Finlow thinks that it will very likely be necessary to produce a race suitable for each distinct tract, and especially for West Bengal where ordinarily the *Deshi* race of jute (*Corchorus olitorius*) is grown.

3.—Agricultural Chemistry.

(1) Sugarcane.

7. (1) **A continuation of the trial of promising varieties.**—Mr Annett has been experimenting with the following five varieties of sugarcane on the Dacca Farm, (1) Dacca Gandari, (2) Yellow Tanna, (3) Striped Tanna, (4) B. 147 and B. 208. Up to date B. 147 is the most promising of these. It has a richer juice and yields far more heavily than the local Gandari. But being a hard cane it is not suitable for chewing purposes. B. 208, as reported last year, has the highest percentage of sugar in the juice, but it is rather too soft and too delicate for Dacca. It requires to be fenced in order to keep out pigs and jackals. Yellow Tanna, though not very rich, is very hardy and a good yielder. Striped Tanna is a thick cane with a luxuriant growth, but it has been discarded from the present year's experiments on account of the impurity of its juice and the difficulty of crushing it. In its place a thin cane, called Sarethi of Aligarh, has been substituted and is reported to be doing extremely well.

Ratoon canes of all the five varieties were grown from the previous year's plant canes ; but they were badly attacked both by red rot and the stem-borer.

Several other varieties are also under examination, namely, (1) Red Mauritius and (2) Barbadoes 3,412, both of which have done well in Southern India ; (3) Java from Coimbatore, (4) Java No. 247 also from Coimbatore, (5) Java No. 36 from the Central Provinces, (6) Java No. 33 from the United Provinces, and (7) Sunnabili from the Central Provinces.

(2) **Experiments on drainage of sugarcane.**—Four experiments have been laid out on the Chinsura Farm where much land is low-lying and during the rains liable to water-logging. Two of these areas have been drained with open drains on the Java system. The drains can serve as irrigation channels during the dry season and they can drain off the water during the wet weather. The remaining two areas have the same varieties of cane grown on the ordinary country system as control plots. But owing to want of water at sowing time the germination was very bad and the experiment is not likely to give any useful result.

(3) **Collection of Bengal varieties.**—Last year 14 varieties were grown at the Dacca Farm with the idea of making a survey of the canes grown in this Province. This year 44 other varieties from different districts have been added to the number. It is hoped gradually to collect and study all the varieties grown in Bengal. When the canes are classified it will doubtless be found that in many cases canes known by different names in different district will turn out to be of the same variety.

(2) Palm Sugar Investigations.

(1) **Field-work.**—Government has sanctioned the purchase of a small apparatus from America such as is used there for the production of maple sugar. The plant ordered should deal rapidly with the juice of a large number of date trees. It is now on its way and is to be tried next cold weather in the Jessore district. Metal collecting buckets for the juice are also being imported.

In Madras lime is used in the pots to prevent fermentation. This will be tried in Bengal.

It is also proposed to collect the juice from the pots in large gathering tanks. These will be transported from distant gardens in carts or boats to the sugar making house. This should save much labour.

(2) **Marketing the date gur.**—In Bengal the date *gur* is semi-liquid and has to be carried in earthen pots, whereas in Madras it is produced in a more solid form admitting of its transport in gunnybags. The same bags may be used over and over again. To get out the *gur* from the earthen pots in Bengal, however, the pots have to be broken, pieces of which get into the filter bags of refineries and often cut them. This means both expense and trouble. It is proposed to try the Madras system here.

(3) **Laboratory work.**—An attempt is being made to elucidate the mechanism of the production of sugar in palm trees. No trace of any enzyme has hitherto been found in the juice of the date palm. This suggests that sugar is produced in the palm tissues by extra cellular enzymes.

(3) Soil Survey.

Owing to the loss of his first assistant Mr. Annett could not make much progress with this work. However the analyses which have so far been made of Bengal soils have been collected together and may be summed up as showing that by far the larger part of the soil of the Province is deficient in lime. In these areas we are quite safe in recommending the use of lime and bonemeal.

A start has been made on the biological analysis of the soils of the plots on the Dacca Farm which have received various kinds of manuring.

4.—Botany.

(1)—Rice.

8. (1) **Pure line cultures.**—The Economic Botanist almost completed the survey of the transplanted varieties of *aman* paddy of East Bengal and began testing several of them on a practical scale. One of these was tried both on the Dacca Farm and in the neighbouring cultivators' fields. On the farm an outturn of 30 maunds and 17 seers per acre was obtained as the average of four plots amounting in all to about 5½ acres. This was a record for the Dacca Farm. In the cultivators' fields it was grown in competition with the best local varieties (namely, *Malothy*, *Lohadung* and *Kartiksinni*) and surpassed them in outturn by a long way.

On the more purely scientific side, work on crossing and inheritance of characters has been continued and some interesting results obtained.

(2) **Seed-rate and specific gravity selection experiments.**—Mention was made in last year's report of the Japanese method of separating heavy seed from light by the help of a solution of common salt. Repeating his experiments of 1913-14 in 1914-15 Mr. Hector sowed three sets of plots with—

(1) Uselected seed at 45 seers per acre (local rate.)
(2) Selected heavy seed at 33 seers per acre.
(3) Rejected light seed from (2) at 11 seers per acre.

The results were not very pronounced; but they tend to prove that the local seed rate is probably too high.

(3) **Ufra disease.**—The experiments to find some means of checking *ufra* disease were continued at Chowmohani and Bikrampur. They simply consist of burning thoroughly the stubble left in the field after harvest and giving the land repeated ploughings up till sowing time. *Ufra*, however,

is very capricious in its appearance and at Bikrampur for the second year the disease did not appear on the experimental plot, while at Chowmohani only one plot was slightly attacked. No conclusion can therefore be drawn as to the efficiency of the measures. It is hoped also that it may be found possible to combat the pest by growing immune varieties. Mr. Hector doubts if there is any variety directly immune; but some varieties appear to escape owing to their ripening early in the season before the attack becomes virulent. One such, at least, is known, and work was started during the year under review to ascertain the extent of its immunity, while a search for other such varieties, was also commenced.

The Imperial Mycologist's experiments in this connection at Comilla have been noticed elsewhere.

(2) Other work.

(1) The work on local pulses, oilseeds and chillies was continued. It is proposed to start testing on a practical scale several selected types of each of these crops during the present season.

(2) The fruit experiments at Dacca were continued. In May 1915, Mr. Hector and Mr. McLean visited Kalimpong to draw up a scheme for fruit growing in the Darjeeling District. They were accompanied by Mr. Proudlock, formerly Arboricultural Expert under this Department. The scheme is under the consideration of Government.

5.—Entomology.

9. The Imperial Entomologist has furnished a report showing the insect pests sent to him from Bengal in the course of the year. These were identified by him and remedial measures suggested to check their further ravages. Among others, the Superintendent of the Jalpaiguri Jail forwarded specimens of two kinds of insectdestroying cauliflowers in the jail gardens, which proved to be the large Brown Cricket (*Brachytrypes portentuosus*) and the Greasy Cutworm (*Agrotis Ypsilon*); he also sent some samples of stored rice damaged by insects which, on examination, were found to be *Calandra oryzæ*. Mr. J. Malcolm of the Ramnaggar concern in the district of Nadia, sent specimens of caterpillars destroying his jute crop, which were found to be the Jute Semilooper.

The Entomological Collector under the department has also submitted his report in which the chief items of his work during the year are mentioned as below :—

(1) Further investigation into the "Bhapu" disease of paddy. It was found to be due to the attack of a fly maggot, most probably *Cecidomyia oryzæ*.

(2) Investigation, in co-operation with the Mycological Collector, into a suspected paddy disease which did considerable damage to transplanted paddy in West Bengal.

(3) Investigation into the Palmleaf Caterpillar ("Niphantis Serinopa") which did great injury to palm trees in West Bengal. A leaflet has been published dealing with this pest.

(4) Further experiments to check the mango weevil by the kerosine oil treatment.

(5) Spraying demonstration of Vermisapon Special K for red spider on *ganja*.

The Entomological Collector also observed and treated the following insect pests on the crops of the Dacca Farm :—

Rice stemborer ("Schœnobius bipunctifer", loc. "Majra").
Rice case worm ("Nymphula depunctatis", loc. "Chonga poka").
Orangebanded blister beetle ("Mylabris pustulata").
Cotton leaf roller ("Sylepta derogata").
Mango shoot borer (Alcides sp.).
Mango hairy caterpillar ("Cricula trifenistrata", loc. "Beechha poka").

The litchi mite (" Phytoptus sp.").
Red spotted scale (" Aspidiotus sp. ").
Large brown cricket (" Brachytrypes achatinus," loc. " Urchunga ").
Jute semilooper (" Cosmophila sabulifera," loc. " Chhat poka ").
Jute stem weevil (" Apion sp.").
Behar hairy caterpillar (" Diacrisia obliqua," loc. " Beechha poka ").
Mothborer (" Chilo sp.", loc. " Majra ").
White mothborer (" Scirophaga auriflua ", loc. " Sada majra ").
Pulse beetle (" Bruchus sp.").

To check the ravages of the above insects spraying, handpicking, fumigation, etc., were resorted to wherever possible.

In the course of the year a set of lantern slides illustrating spraying, bagging, fumigation, etc., as means of controlling insect pests was prepared to be shown in exhibitions ; and show-cases containing important insect pests were exhibited in certain exhibitions held during the year.

6.—Mycology.

10. The Imperial Mycologist has furnished a report on his work in Bengal, the most important of which was his investigations into the " Ufra " disease of paddy. He reports that his experiment at Comilla last year in this connection was not a success, and so the experiment is being repeated this year. A smaller experiment at Pusa, however, indicated that firing the surface of the soil was a provocative on a small area. Work was also done on a disease of betelvine which occurs in the vicinity of Bogra and which was found to be due to a species of *Rhizoctonia*. A disease of *areca* palm occurring in Khulna was also studied.

The Mycological Collector under the department has also submitted a report of his work in the course of the year. Most of his time was devoted to supervising experiments in connection with the " Ufra " disease of paddy in Noakhali, Laksam, Bikrampur and Comilla. A survey was started during the year of the " Ufra " infected tract of the Dacca district, with the object of getting accurate information as to the exact area infested by the disease and to see whether it shows any tendency to spread ; and if so, in what direction. Certain fungus diseases on the crops of the Dacca Farm were observed and necessary remedial measures were tried.

The Mycological Collector attended during the year the Feni and Banderkhola (Faridpur) exhibitions also the potato exhibitions at Harinarayanpur (Noakhali), where specimens of the more important fungoid parasites were exhibited, their life history explained, and instruction given to the visitors as to the best methods of checking them.

7.—Sericulture.

11. **Hybridising Experiment.**—The work in connection with the hybridising experiments, which were being carried on by Mr. E. Grangeon, Sericultural Expert, before he went on leave for the front in France, is being continued by Mr. P. C. Chaudhuri, Superintendent, Berhampur Central Nursery, in addition to his own duties. The experiments fall under the following main heads :—

(1) Crosses of indigenous races with the multivoltine Madagascar race in various mixtures of blood.
(2) Crosses of indigenous races with the accidental bivoltine races derived from a pure univoltine race.
(3) Improvement of indigenous breeds by selection and rearing by families.

As a result of the crossings several multivoltine races have been obtained, yielding yellow cocoons and resembling the indigenous races in larval markings and physical appearance, which will suit the taste of the local rearers. The races show signs of promise. The results of the experiments conducted for the improvement of indigenous races were also encouraging.

The yield of silk in each case has been considerably increased.

As the crosses cannot stand the effects of the climate of the plains during the months of May to September, they were sent to Kurseong, where a sericultural station was started in 1914, with a view to preserve their quality. The races will be brought down to the plains in August for supply to the rearers in October. The principal aim of the scheme is to substitute these improved cross races for the indigenous races during the months from October to April, whilst during the rest of the year (from May to September) the rearers will be supplied with selected Nistaries. It is hoped that the rearers will in this way derive more profit than by rearing the indigenous races only throughout the year.

12. **Miss Cleghorn's Experiment.**—During the year a grant of Rs. 5,000 per annum for five years for the present was sanctioned by Government for Miss Cleghorn to continue and extend her scientific research work in connection with silk rearing. An initial expenditure of Rs. 5,615 was also sanctioned for the purpose. She has commenced her work at No. 5, Alipore Road.

A multivoltine hybrid race of silk worms started in January, 1911 and reared on a small scale is now being continued on a much larger scale, and the 36th generation of this cross has given cocoons superior to the Nistari.

New plantations of mulberry have been made and they are progressing well.

13. **Sericulture—General.**—The original idea of the scheme to save the silk industry of Bengal was to produce all the seed cocoons necessary for the province free from disease in Government nurseries and to supply them to the rearers.

In pursuance of the scheme seven central nurseries have been established at the following places :—

Piasbari, Amriti (Malda).
Berhampur, Chandanpur, Kumarpur (Murshidabad).
Mirganj (Rajshahi).
Kalitha (Birbhum).

There is also a nursery at Bogra for Exchange of *Chhotapoloo* seed.

In order to ascertain the total number of central nurseries which would be required to meet the demand of all the rearers of the province for seed, a census of mulberry fields was taken during the year. It revealed the fact that no fewer than 22 central nurseries would have to be established in order to meet the requirements of the whole province by this method. But the expenditure (both capital and annual) on each central nursery is so heavy and the income derived so far below even the annual expenditure that the establishment of a large number of such nurseries would really amount to giving the industry a very large subsidy. The same object can, however, be achieved in a much less expensive way. In France, Italy, Japan and China Government does not attempt to supply the entire seed required by Government agency alone. The principal quantity is supplied through professional rearers working under Government supervision. Further it is essential that in the interests of the existing professional rearers the whole work should not be undertaken by Government. It is therefore now proposed that only one-third of the total demand should be reared in Government nurseries and that the remainder should be reared by selected professional rearers under Government supervision. The whole scheme is now under the consideration of Government; but meanwhile an experiment is being made to see in a few cases whether healthy seed cannot be raised under Government supervision in the houses of selected professional rearers.

The disinfection of village rearing houses was continued with good results during the year under report; and, in order to make the new scheme a success, closer attention is being given to this work. The work was formerly entrusted to men who were not adequately supervised; but now these men work directly under the supervision of Assistant Superintendents of nurseries.

The Superintendent of Sericulture reports that already some very encouraging results have been obtained.

Six professional rearers' sons were trained in the sericultural class at the Berhampur Central Nursery. Of these two passed the final examination and were paid a reward of Rs. 250 each. They have constructed model rearing houses with the money and have started rearing.

The total quantity of seed sold during the year was 8,145 *kahans* 6 *pons* and one *ganda* and the price obtained thereform was Rs. 10,170-4-6. The total receipt from the outturn of the nurseries from 1st July 1914 to 30th June 1915 came to Rs. 13,069-1-9 against Rs. 8,324-3 of the preceding year. The total expenditure, including the office establishment, was Rs. 1,24,725-9-5.

14. **Rajshahi Sericultural School.**—There were 11 boys in the beginning of the year at the Rajshahi Sericultural School. Ten appeared at the final examination and passed. They will receive their rewards in the next winter. Four boys of the previous year received the second instalments of their rewards of Rs. 250 each and a microscope. There were 12 boys on the roll on the 30th June, 7 of whom are Muhammadans and 5 Hindus. The cocoons reared in the school are said to be gaining popularity among the rearers. The school possesses 22 bighas of land, of which 15 bighas are under mulberry cultivation against 8 of the previous year. The total receipt was Rs. 389-10 against Rs. 427 of the previous year. The total expenditure was Rs. 6,232.

8.—Fisheries.

15. Mr. Southwell has submitted an elaborate report on his last year's work which has been published *verbatim* separately along with the reports of the other expert officers. During the year the department was provided with a steam launch. The Deputy Director will now be able to study effectively the problem of the breeding grounds of the *hilsa* and to begin the work of a systematic survey of the fisheries of the Sundarbans. The launch is also useful for carrying on propaganda work in fishing villages. Instruction in general fishery matters was also given by the officers of the Fishery Department at agricultural exhibitions. Mr. Southwell is always trying to obtain first hand information relating to the actual condition of the fisheries and of the difficulties under which the fishermen labour. Their difficulties are two-fold, viz. :—

(1) a growing scarcity of fish and
(2) their great poverty, on account of which large numbers of them are forsaking their vocations for the more lucrative agricultural pursuits.

Mr. Southwell made a thorough and systematic survey of the fishery rights in the main rivers. As a result of his enquiry a map has been prepared indicating those fisheries which are permanently settled and those which are owned by Government. The Government fisheries are administered by the Collector of the district in which the fisheries are situated. Both permanently settled fisheries and Government fisheries are usually leased out. The lessee sub-leases in small lots and the fishermen have not only to pay for the privilege of fishing, but they are almost invariably obliged to sell their fish to the lessee at a low figure. This partly accounts for the poverty of fishermen. It also partly explains why the price of fish is so high. To remedy the evil, it is desirable to induce fishermen to take leases of fisheries direct from Government, after they have formed themselves into Co-operative Societies. The experiment will at first be limited to the Government fisheries ; but, if successful, it will be extended so as to include permanently settled estates. The Fishery Department is now in a position to take up systematically the establishment of Co-operative Societies at suitable places and to adapt them so as to meet particular local requirements.

The main problem which the Fishery Department has to deal with is how to increase the fish supply of the province, which at present falls far short of the local demand. As regards the estuarine fisheries, a survey was made with the launch of the Hooghly fisheries from Calcutta to Mud

Point and of the river fisheries in the district of Khulna. This covers no more than an area of 200 square miles out of a total area of about 5,700 square miles covered by the estuarine fisheries of the Sunderbans, and hence it will be premature to arrive at general conclusions until the investigations are further extended. From the limited enquiries that have been made of these fisheries Mr. Southwell is inclined to think that trawling even with small nets will never be possible in the Sunderbans. Drift nets are equally unsuitable. The native methods of fishing leave nothing to be desired in point of effectiveness, but the fishermen are generally so poor that they cannot afford to buy or make new and better nets ; and for this the establishment of Co-operative Societies among fishermen is of the highest importance. Such societies would not only effect an amelioration of the lot of the fishermen, but would do much towards organising the fish trade and placing it on a more satisfactory basis.

To increase the supply of edible fish it would also be necessary to have recourse to the artificial cultivation of certain species. The *carp* and the *hilsa* being the most important of the good fishes in the province, attention has been paid from the very beginning to the culture of these fishes. Culture of certain predatory fish, such as *chital*, *sal*, *singhee*, etc., is also being tried. As regards *carp*-culture, attempts were made in previous years to make them breed in stagnant water, as is done in European countries ; but experience has established that the Indian *carp* will not breed in tanks. Mr. Southwell's researches have, however, shown that *carp* eggs can be artificially fertilized, and for this, small *carp* hatcheries have been established at Buxar and Cuttack. The operations are still in an experimental stage.

The fishery department supplied during the last year, at cost price, large numbers of *carp fry* for the purpose of stocking tanks. The *fry* are usually obtained from the fishermen of Amta and Champadanga who collect them every year from the Damodar during the rains. During the rainy season of 1914 over five lakhs of *carp fry* were distributed and arrangements were made with the railway authorities so that persons coming from the mufassal to fetch their consignments were given every facility to exercise necessary care over the *fry* while in transit. The same arrangement has been made this year also, and it is expected that there will be a much larger traffic in *fry* during the coming rains.

The difficulty of stocking tanks with *fry* is two-fold, viz., (1) that the *fry* almost invariably consists of several species and thus predatory fish continue to be introduced into tanks, and (2) that the *fry* sold for stocking tanks are so small that they are readily devoured by any voracious fish living in the tank into which they are introduced. To obviate these difficulties it is necessary that the tanks should be stocked with *carp* only, and that these should be of such a size as to be immune from the attacks of predatory fish ; but this cannot be done satisfactorily unless the *fry* supplied to the public are grown in our own hatcheries and reared under the direct supervision of the officers of the department. With regard to *hilsa*-culture, experimental hatcheries have been established at Buxar and Cuttack.

During the year under report, Mr. Southwell, with the Fishery Superintendent Mr. B. Das, conducted enquiries into the fresh water pearl mussel fisheries as well as into the Terrapin and Mud-turtle fisheries in the province. The results of these investigations have been embodied in a Bulletin (No. 7) of the Fishery Department. The mussel fisheries are of great importance because they yield a fair harvest of pearls, the small shells being utilized in the manufacture of lime, and the large ones being used for making pearl buttons and ornaments such as earrings, nosependants, watch chains, etc. Button making is a domestic industry over a large area in Eastern Bengal, particularly in the Dacca district. Mussels have been fished in Bengal—principally for pearls—for a long time. Until lately the shells were burnt for lime only. Button and ornament making is comparatively a modern industry in the province. Some 20 or 30 years ago the mussel fisheries in the Bhandardah *beel* in the district of Murshidabad were of an extensive nature, giving temporary employment to large number of fishermen from neighbouring villages. It is stated that about 50,000 maunds of shells were sometimes fished in one season. The mussels are also to be found in most of the smaller rivers in Bengal and Bihar and Orissa, in *khals* and even in tanks ; but there

is ample indication that the supply is diminishing and the Fishery Officers are therefore engaged in studying the life history of the mussel in order to ascertain the cause of deterioration of these fisheries. A preliminary enquiry into the turtle fisheries in the province shows that the industry is principally located in the districts of Bakarganj, Khulna and Faridpur and that the catches per annum are no less than 70,000 turtles of all species. The wholesale value is about Rs. 42,000, and the retail value probably nearly double that amount.

During the year, statistics relating to fish traffic for the year ending 31st March 1914 were collected. This shows a decrease in the imports into Calcutta both by the railways and canals, the total decrease being about 40,000 maunds over the previous year's figures. This decrease may be ascribed partly to the development of inland trade and to the increasing use which is being made of the railway facilities in various parts of the area in question. Another cause is the gradual silting up of *beels* and the encroachment of them for purposes of cultivation. A further contributing cause is the fact that numbers of fishermen are leaving their profession to adopt more profitable agricultural pursuits.

A considerable amount of scientific research was carried on by Mr. Southwell in the Fishery Laboratory in the Indian Museum as well as on board the launch, with the result that a large number of larval parasites and fish lice have been discovered and described. The cause of mortality amongst the trout in the streams and lakes near Nainital has been found to be a disease known as goitre (*carcinoma* of the *thyroid*).

Mr. Southwell can be congratulated on the good work he has done during the year. As the Fishery Department expands, an appreciable effect will be produced on the fish supply of the province. Mr. Southwell has already laid the foundations for the success of future work.

CHAPTER IV.

Agricultural Association Shows and Demonstrations.

16. Besides the Provincial Association there are two Divisional Associations for the Burdwan and Presidency Divisions, each under the presidency of the Commissioner of the Division. There are likewise 13 District Associations with the Collectors of the districts as the presidents. There are also branch associations in each of the subdivisions of the districts of Nadia and Birbhum.

The Provincial Agricultural Association held two meetings during the year under report. The Divisional, the District as well as the Branch Associations had their meetings also, in several of which the officers of this Department were present. The Burdwan and Presidency Divisional Associations each received a grant of Rs. 1,000, which they distributed among the District Associations under them. Of the 16 members of the Presidency Divisional Association Mr. M. M. Crawford of Shikarpur in the district of Nadia is the only one who undertook demonstration work during the year. Of the 38 members of the Burdwan Divisional Agricultural Association, very few did any practical work, and this was partly due to the want of sufficient rain in the season of 1914. Babu Rama Prasanna Mukherji of Kundala in the district of Birbhum grew Nainital and Patna potatoes each on one bigha manured with four cart loads of cowdung and four maunds of castor cake, the outturn being 240 and 220 maunds respectively per acre. He also obtained 35 maunds per acre of Dadkhani paddy from 1 bigha of land after applying 6 cart loads of cowdung. Babu Raja Ram Mitra of Gangajalghati, district Bankura, obtained an outturn of 150, 120 and 60 maunds respectively per acre of Patnai, Naini Tal and *Deshi* variety of potatoes, the land being manured at the rate of 400 maunds of cowdung and 6 maunds of castor cake per bigha. The outturn of *aman* paddy however was only 24 maunds per

acre, though the manure used was 80 maunds of cowdung per bigha and the land green manured with *dhaincha*. Babu Chandi Charan Ghosal of Konnagore, a member of the Burdwan Divisional Association, tried paddy and jute on three plots of land ; one of 6 bighas and another about 3 bighas were manured with cowdung for transplanted paddy and the other measuring about 2½ bighas was manured with decomposed *mouah* (vegetable manure) in which jute was sown with the intention of transplanting paddy as a second crop in the month of August. Preparations were made in good time ; but owing to the failure of the rainfall, very poor results were obtained. Babu Amrita Lal Sil, another member of the Burdwan Divisional Association, planted potatoes on one acre in rotation with *aus* paddy. The paddy was harvested in September, potatoes sown in the second week of November and the crops were gathered in the middle of February. The total cost of cultivation, etc., including the rent of the land for half-year was Rs. 165-8-3, whereas the sale-proceeds of the potatoes (180 maunds) was Rs. 270, leaving a net profit of Rs. 104-8-0 for the acre. The profit of the *aus* paddy cultivated on the same piece of land was Rs. 25-12. Thus the cultivation of *aus* paddy in rotation with potatoes in the same year brought a net profit of Rs. 130-4 per acre. Khan Bahadur Muhammad Shams-uz-Zoha of Sekeddah, district Birbhum, grew *Khari* sugarcane, *Deshi* potatoes, Muzaffarnagar wheat and *Samudrabali* paddy on four plots of land. In spite of the unfavourable condition of the weather, the results were satisfactory, the outturns of sugarcane and potatoes being 45 maunds of *gur* and 120 maunds of potatoes respectively per acre and those of wheat and paddy being 18 and 22½ maunds respectively. Of the members of the Burdwan District Association, Rai Sahib Mritunjay Chatterji grew sugarcane, potatoes and onion, the result obtained in each case being highly satisfactory. Babu Bhut Nath Ghose tried on four plots of land (1) *Balam* rice, (2) jute and potatoes in succession, (3) sugarcane and (4) jute and *aman* in succession ; but owing to want of rain, the results were not very satisfactory. Rai Lalit Mohan Singha Roy Bahadur of Chakdighi experimented with potato and rice, but owing to the early cessation of rain, the crops were a failure. Babu A. C. Samanta as in the last year repeated his experiments with paddy manured with bonemeal, castor-cake and mustard-cake ; but the crop failed owing to failure of rain during the flowering season. Rai Bahadur Mani Lal Roy's experiment on sugarcane also failed for the same reason. Lala Mritunjay Lal, Secretary of the Birbhum District Association, tried *Samudrabali* paddy and Nainital potatoes. The result was satisfactory, the yield of 6 cottahs sown with potatoes being 12 maunds, *i.e*, at the rate of 120 maunds per acre. Very little work was done by the members of the Rampurhat Branch Association. The Bankura District Association supplied its members and certain raiyats at cost price and in certain cases free of cost with castor cake, Meston ploughs and seeds of Nainital potatoes, ground-nut and *dhaincha* for demonstration work, and the following definite results are reported to have been obtained, viz., (*a*) potatoes grow well in the district and Italian potatoes give bigger outturns than the local Patna variety, (*b*) Mauritius white Tanna sugarcane is superior to the local *Khari* cane, the yield of the former being about one and-a-half times that of the local variety. Out of the 16 members of the Midnapore District Association only four did anything practical. Rai Sahib Abinash Chandra Bose, Sub-Registrar of Pingla and a member of the association, experimented with Nainital potatoes in two plots of land, each measuring 100 square yards. Sixteen seers of potato seed were sown and 5 lbs. of nitrate of soda and 5 lbs. of superphosphate were used as manure for each plot. The outturns were 47 maunds 6 seers per acre for one plot and 36 maunds 3½ seers for the other plot. This was better than was expected as the leaves of most of the plants had been partially eaten up by insects. The experiments of the other members, who also tried to compare Darjeeling and Nainital varieties of potatoes, were unsuccessful, a kind of red ant being responsible for the failure of crop in each case. Of the 21 members of the Hooghly District Association only four took any practical interest in the work. They tried demonstration work with jute, sugarcane and potatoes of which the seed was supplied to them from this department. Babu Basanta

Kumar Mitra of Panishala experimented with Nainital and Patna potatoes and potatoes imported from England. He also grew Central Provinces *aus* paddy, and Java, Mauritius and *Khari* canes. He was given Rs. 100 out of the grant for the district for conducting experiments with cotton. Rai Bijoy Narain Kundu Bahadur of Itachuna also conducted experiments with potatoes. Several members of the 24-Parganas District Association tried demonstration work with jute, *aman* paddy and potatoes of the Nainital, Patna and Australian varieties, and some of them obtained satisfactory results, the most important being those of Babu Jitendra Nath Basu, who obtained an outturn of 240 maunds of potatoes per acre. From the report received from the President of the Nadia District Association it appears that experiments conducted by the members of the Association were almost wholly unsuccessful, due partly to drought, partly to the seed having been received late, and partly to damage done to crops by insects. Some good work was done in the district of Murshidabad. To introduce better agricultural methods in the district, the Association, as a preliminary to a systematic policy of carrying on demonstrations, approached a number of gentlemen interested in the matter with a request to place some representative plots of land at their disposal. Most of the gentlemen responded to the appeal, and the Superintendent of Agriculture of the Division was asked to inspect those lands with a view to instituting as many demonstrations as possible in accordance with the demonstrational programme for the division. Some of the members of the Association also carried on demonstration work with several important crops grown in the district and obtained satisfactory results in many cases. Babu Prasanna Nath De, a member of the Association, tried Mauritius sugarcane on 15 cottahs of land, using as manure 5 maunds of castor-cake and 1½ maunds of superphosphate. The result was an yield of 1,800 canes of an average length of about 15 feet. With cowdung he got an average outturn of 34½ maunds of *aman* paddy per acre, the average yield of this crop from an unmanured plot usually varying from 15 to 20 maunds per acre. This gentleman also grew cabbage and cauliflowers using stable refuse and cowdung as manure, the yield being on an average of 1,444 plants, each of a respectable size. He also tried cowdung and bonemeal with onion and capsicum. Good outturns were obtained in each case. Babu Preo Nath Mukherji, a member of the Jessore District Association, obtained an outturn of 60 maunds per bigha of Nainital potatoes, using 100 maunds of cowdung and 1 maund of castor-cake as manure against 50 maunds per bigha with cowdung only and 40 maunds without any manure. The Secretary of the Khulna District Association tried country and *tosha* jute, fine and coarse *aus* paddy, mustard, potatoes, and other vegetables in the Khulna Farm. He obtained fair result from Darjeeling potatoes and *aus* paddy. The Subdivisional Officer, Bagerhat, tried Nainital potato on two small plots of land. The outturn obtained from one of the plots appears to be fair, being 83 maunds per acre.

The demonstration work in the East Bengal districts is principally carried on under the direct supervision of the officers of this department. There are agricultural associations in three districts only, viz., Rangpur, Malda and Bogra. With regard to the question of starting similar associations in other districts it has been decided to leave the matter in the hands of the District Officers. Six members of the Rangpur District Association tried bonemeal on jute, paddy and mustard. Several members grew Darjeeling potatoes, the outturns being satisfactory in certain cases. Some members also grew *Kataribhog* and *Badshabhog* paddy and tried cowpea as green manure for tobacco. The Meston plough and the Planet junior hand hoe are being used more extensively by the members of this association. The principal work of the Malda District Association during the year under report was the distribution of bonemeal to cultivators and potato seed among the local people. The manure was found very effective for mulberry and wheat; mango trees were also benefited by its application. The potato crop, however, proved a total failure. Babu Kashi Prosad Roy, a member of the Bogra Association, tried sugarcane, potatoes, brinjal and China grain with fairly good results in most cases; in the case of brinjal his outturn of about 80 maunds per bigha was surely a very satisfactory result.

Agricultural Demonstrations conducted by the Department.

17. The reports of the Superintendents of Agriculture, which are published separately, contain the full details of the demonstration work conducted in each division during the year under report. The Deputy Directors have each given descriptive notes for their divisions.

Demonstration work in the Burdwan and Presidency Divisions was, during the early part of the year, conducted by the members of the agricultural associations of those divisions; but later on demonstration plots were started at 33 places in the former division and at 18 places in the latter division in the cultivator's fields, as is done in East Bengal. Owing to drought in the autumn the result of demonstration work in the Burdwan Division was not very satisfactory.

The main items of the demonstrations were :—

(1) **Effect of bonemeal on paddy and jute.**—Bonemeal demonstrations were conducted during the year in 300 plots, viz., 263 plots with paddy and 37 plots with jute. They were attended with varying degrees of success in all the divisions except in the district of Rangpur, where the results obtained did not show any marked advantage from the use of bonemeal.

An attempt is also being made to demonstrate, in the cultivators' fields around the Dacca Farm, the advantage of using bonemeal and lime in red soils.

(2) **Introduction of superior varieties of seeds.**—Potato demonstrations were carried out in 981 plots, and it has been definitely proved that the Darjeeling variety is the best of all varieties. In the Faridpur district the net profit per acre came up to Rs. 200 to Rs. 300. In the Rajshahi Division the approximate yield was about 300 maunds per acre. People have appreciated its cultivation to such an extent that the demand for the seed potatoes is increasing annually.

Cuttings of the Tanna variety of sugarcane as well as of some other good varieties of cane were distributed in the Burdwan, Rajshahi and Dacca Divisions, and it is reported that the resulting crops are doing well.

A considerable quantity of pure paddy and jute seed raised by the Fibre Expert and the Economic Botanist by the method of single line culture has been distributed among 144 cultivators of the Dacca Division, and is being tried against the cultivators' best seed. In the Rajshahi Division 2 maunds of Mr. Finlow's jute seed is also being tried side by side with the cultivators' seed. The results will be published in next year's report.

Various sorts of fodder crops were tried with success in the Dacca and Rajshahi Divisions, and with a view to popularize the cultivation of *juar* in Rangpur some seed was distributed free of cost among some selected cultivators.

(3) **Seed selection.**—The method of seed selection which was pursued last year has been continued, and this work is gaining favour with the cultivators. Selected paddy and jute seed was sown in 143 plots in the Dacca, Chittagong and Rajshahi Divisions, along with the ordinary seed and the results obtained from the former are encouraging in all the places.

(4) **Conservation of cattle dung.**—During the year 307 new pits were made in the East Bengal districts. Cultivators are now well convinced of the value of the conserved cattle dung and the number of pits is gradually increasing specially in the Dacca Division.

(5) **Introduction of improved agricultural implements.**—Demonstration on the use of the Planet junior hand hoe, Meston plough, Knapsack sprayer and iron *don* were conducted in all the divisions with success. In the hard soil of Birbhum and Bankura, the Planet junior hand hoe and Meston plough did not work satisfactorily. Several Meston ploughs, hand hoes and iron *dons* were supplied to the cultivators during the year under report and the people are well convinced of the benefit of their use.

(6) **Growing of dhaincha, sun-hemp and cow-pea as a green manure.**—Attemps were made to extend the use of these cheap forms of manuring where they could be profitably introduced.

Agricultural Shows and Fairs

18. Nineteen agricultural shows including five potato exhibitions were held during the year under report as compared with 18 of the last year. A statement giving details of these shows will be found in Appendix I. The total contribution made by the department to these shows amounted to Rs. 2,650, which includes Rs. 900 for the potato exhibitions. The shows were for the most part industrial as well as agricultural, and in some of them such as at Suri, Banjetia, etc., cattle were also exhibited. Officers of the Agricultural Department attended the shows and exhibited departmental exhibits. Officers of the Fishery Department also attended some of the exhibitions with fishery exhibits. The Entomological and Mycological Sections of the department were represented at some of the exhibitions.

Last year, at a meeting of the Bengal Provincial Agricultural Association, Babu Sarada Charan Mitter, a member of the Association, suggested that steps should be taken to hold agricultural exhibitions at rural centres instead of in towns. The suggestion was communicated to the District Officers, and the majority of their replies referred to the difficulties of holding exhibitions in out of the way places. The question was discussed again at a subsequent meeting of the Association, and it was held that subdivisional head-quarters were more suitable for the purpose of holding exhibitions than less central localities.

CHAPTER V.

Publication of Agricultural information and supply of seeds, manures and implements.

19. The following leaflets, bulletins and reports were published by the department during the year under report :—

(1) *Leaflet No. 1 of 1915*—The Palm-leaf Caterpillar (in English and Bengali).
(2) *Leaflet No. 2 of 1915*—The Palm-beetle (in English and Bengali).
(3) *Bulletin on Bonemeal Manure in Bengal.*
(4) " Krishi-Samachar " or Year Book of the department in Bengali for the year 1319-20 B.S.
(5) " Season and Crop Report for 1913-14 and 1914-15."
(6) " Annual Report of the Department of Agriculture, Bengal, for the year ending 30th June 1914."
(7) " Annual Report of the Expert Officers of the Department of Agriculture, Bengal, for the year ending 30th June 1914."

The Fishery Branch of this department published the following bulletins in the course of the year :—

(1) *Bulletin No. 5.*—A report on fishery investigation in Bengal and Bihar and Orissa with recommendation for future work.
(2) *Bulletin No. 6.*—A report on the fish trade in Bengal, Bihar and Orissa for the year ending 31st March 1914.
(3) *Bulletin No. 7.*—Report on (*a*) the Mud-turtle and Terappin fisheries in Bengal, (*b*) fresh water pearl mussel fisheries in Bengal and Bihar, and the industries connected therewith. In addition to the above, the Deputy Director of fisheries contributed the following papers to the Records of the Indian Museum :—

(1) A paper describing a large number of fish diseases.
(2) A report on parasites from fish and aquatic birds in the Chilka Lake.

Supply of Seeds.

20. The Central Seed Store at Sibpur was retained for the greater part of the year, and was the chief source of supply of seeds, etc., for the whole Province. Towards the end of the year separate seed stores were opened in each division under the respective Superintendents of Agriculture, and Sibpur became the seed store for the Burdwan Division. Quite recently the seed store at Sibpur has been abolished and a seed store for the Burdwan Division has been established at a place near the Howrah Railway Station.

The following seeds, etc., were distributed from the Sibpur Seed Store during the year :—

Potato	120	maunds.
Other seeds	464¾	„
Manures	1,152½	„ (chiefly bonemeal).
Implements	29	in number.

The Superintendent of Agriculture, Dacca Division, was sent to Darjeeling in September last to purchase Darjeeling potatoes for distribution in the Province. About 1,430 maunds of seed were purchased and supplied. Some 204 maunds of Nainital seed potatoes were also supplied from Calcutta.

CHAPTER VI.

Miscellaneous.

21. **Arboriculture.**—Progress reports of arboricultural work for the financial year 1914-15 have been received from all the districts. The expenditure incurred by District Boards on planting out trees, gabions, nurseries, etc., and the receipt from the sale of fruits, trees, etc., amounted to Rs. 34,167-7-9 and Rs. 4,644-9-6, respectively. Decennial schemes of arboricultural work have been received from all the districts except Dacca, Tippera and Jessore. The highest expenditure on arboriculture was incurred in the districts of Mymensingh, Malda and Midnapur.

The class for the training of Overseers and other subordinates of District Boards in arboriculture was held at the Royal Botanic Garden, Sibpur, from 12th August to 11th September 1914. The Superintendent reports that 7 officers attended the course.

22. **Weaving operations.**—Mr. N. N. Pillai, the Weaving Master, spent altogether 296 days out on tour in visiting almost all the weaving centres in the districts of Faridpore, Mymensingh, Malda, Pabna, Dacca, Bakerganj, Chittagong, Tippera, Berhampur, Hooghly and Midnapur, with the principal object of organizing Weavers' Co-operative Societies in important centres for the benefit of local weavers. Several new societies were started last year with the approval of the Registrar of the Co-operative Credit Societies, no fewer than six societies being organized in the district of Faridpur alone, namely, at Paschim Sadardhi, Nurpur, Magikanta, Amirthi, Janti and Alipore. The objects of these societies are for the present to supply genuine raw-materials to the members at a low cost, quite similar to their samples and also to advantageously dispose of the fabrics manufactured by them. In every place visited by the Weaving Master he demonstrated the advantages of his improved reeling machine as well as of the automatic fly-shuttle loom to the weavers. The silk reelers of Shujatpur (district Malda) highly appreciated Mr. Pillai's improved machines, so much so that he had six such machines made for distribution among selected professional reelers of the locality, arrangements being made to realise the cost by monthly instalments ; and at the request of the silk reelers of Sibgunge in the same district, he is constructing a new type of automatic dobby for automatically working out floral designs on the borders of silk fabrics manufactured there. At Berhampur not only were the advantages of the improved machine demonstrated

to the reelers, but the wool-weavers of the locality were also taught how to destroy germs in wool by treating it with copper sulphate solution, sulphur fumes, etc., and also how to remove yolk from the wool or from the fabric by immersion in soft soap solutions.

Thus it will be seen that a considerable amount of work was done last year ; but the weaving class in this province is generally too poor to be able to purchase improved machinery or material for their work, and until a more extensive system of Co-operative Societies can be introduced among them it will not be possible to expect any satisfactory result in this direction.

23. **Rainfall.**—During the year under report the total number of rainfall stations in the province was 227. Three new stations were opened, and two stations were closed during the year.

The statement below gives the number of rainfall stations in each district and the number inspected during the year :—

District.	Number of rain gauge stations.	Number of rain gauge stations inspected.	District.	Number of rain gauge stations.	Number of rain gauge stations inspected.
24-Parganas ...	9	...	Rangpur ...	9	2
Nadia ...	6	1	Bogra ...	5	1
Murshidabad ...	10	8	Pabna ...	4	1
Jessore ...	5	...	Malda ...	6	4
Khulna ...	12	4	Dacca ...	8	...
Burdwan ...	8	...	Mymensingh ...	11	3
Birbhum ...	6	...	Faridpur ...	10	...
Bankura ...	13	2	Bakarganj ...	8	...
Midnapur ...	26	...	Chittagong ...	6	...
Hooghly ...	3	...	Tippera ...	8	...
Howrah ...	4	...	Noakhali ...	7	2
Rajshahi ...	7	...	Chittagong Hill Tracts.	3	...
Dinajpur ..	13	...	Hill Tippera ...	1	...
Jalpaiguri ...	8	...	Cooch Behar ...	5	2
Darjeeling ...	6	...			

24. **Agricultural Implements.**—A list of the agricultural implements and machines reported to have been tested in the province during the year is given in Appendix II.

25. **Seed Rates.**—The following statement shows seed rates per acre of the principal crops in the Presidency and Burdwan Divisions. The information for Dacca, Rajshahi and Chittagong Divisions was given in the Annual Report of the last year.

Name of the crop.	Seed rates per acre.	
	Presidency Division.	Burdwan Division.
Aman paddy transplanted ...	20 seers	12 to 16 seers.
Ditto broadcast ...	30 „	9 to 12 „
Aus paddy transplanted ...	20 „	.....
Ditto broadcast ...	30 „	.....
Boro paddy	25 „	.....
Jute	3 „	4½ seers.
Potato	10 mds.	10 to 15 mds.
Wheat	1 md.	20 seers.
Gram	1 „	30 „
Lentil	25 seers	20 „
Mustard	5 „	5 „
Sugarcane	12,000 cuttings	12,000 to 16,000 cuttings.
Tobacco	1 ounce	.....

26. **General.**—No new scheme was undertaken during the year, but progress has been made in various directions. An additional Deputy Director of Agriculture was appointed during the year and the demonstration staff was expanded. Satisfactory results have been achieved in various items of

demonstration, and the work of seed selection is giving increasingly satisfactory results. We shall be in a position next year to decide whether the seed developed by the experts should be multiplied on private seed-farms. The establishment of divisional seed stores will facilitate greatly in future the supply of improved seeds, manures and implements. An improvement was effected in the work of preparing the jute forecast by having the bulk of the work of checking the entries of figures for acreage in the punchayati forecast schedules done during the months of May and June. In the Presidency and Burdwan Divisions, however, a good deal of this work will still have to be done during July and August. The forecast figures are now being accepted by the trade as being substantially accurate. In the Fishery Department very satisfactory progress was made and large quantities of *fry* are now being distributed to the public. In the Sericultural Department the scheme for supplying all the seed needed for the Province free from disease is being gradually worked out and should, before long, be brought to completion. The report of the survey and census of the cattle of Bengal has been published, in which proposals have been made for effecting an improvement in the cattle of the Province. The Rangpur Dairy Farm has not yet proved itself financially profitable ; but there is no reason why it should not do so ultimately. The experience gained shows that for the first two years a loss will be incurred. But when once the full area under sugarcane has been laid down and the inferior animals of the herd have been eliminated, the scheme should prove more and more to be financially profitable. The work done by the Agricultural Chemist in soil analysis and in connection with sugarcane and the date palm is also of considerable importance and ought soon to bear fruit. Increasing use is being made of Co-operative Societies for furthering the use of improved manures, implements and seeds. The Fishery and Weaving Departments are also gradually being brought into touch with the co-operative movement. In the Fishery Department Mr. Southwell has been successful in supplying a large quantity of *carp-fry* to the public. It is probable that in the near future the Fishery Department will be able to exercise an appreciable influence in increasing the fish supply of the Province.

APPENDIX I.

Agricultural Shows and Fairs.

Serial No.	NAME OF FAIR AND LOCALITY.	Dates on which the exhibition was held.	Amount contributed by the Agricultural Department.	Officers of the Department who attended or helped in the Agricultural shows.	Exhibits sent and demonstrations given by the Department.
1	2	3	4	5	6
	PRESIDENCY DIVISION.		Rs.		
1	Agricultural and Industrial Exhibition, Maherpore (Nadia).	29th January 1915 to 4th February 1915.	200	First Deputy Director of Agriculture and a District Agricultural Officer (Mr. Krishnan).	Departmental exhibits, irrigation by pumps, *gur* making and ploughing.
2	Agricultural and Industrial Exhibition, Banjetia (Murshidabad).	1st February 1915 and three following days	300	First Deputy Director of Agricultural and Superintendent of Agriculture, Presidency Division.	Departmental exhibits, irrigation by pumps and *dons*, *gur* making and ploughing.
3	Keserpahar Agricultural and Industrial Exhibition, Kandi Subdivition (Murshidabad).	3rd to 10th February 1915.	100	One Demonstrator attended ...	Departmental exhibits.
	RAJSHAHI DIVISION.				
4	Flower and Vegetable Show, Kurseong (Darjeeling).	5th April 1915	100	First Deputy Director of Agriculture.	Departmental exhibits, seeds, implements and manures recommended by the Department.
5	Agricultural Exhibition, Falakata (Jalpaiguri).	29th January 1915.	Nil.	First Deputy Director of Agriculture and two Demonstrators.	Ditto, ditto.
6	Paikar Mela (Bogra) ...	16th to 22nd February 1915.	Nil.	Superintendent of Agriculture, Rajshahi Division.	Departmental exhibits.
	BURDWAN DIVISION.				
7	Suri Cattle and Produce show (Birbhum).	30th January 1915 and four following days.	300	Deputy Director of Agriculture and Superintendent of Agriculture, Burdwan Division.	Departmental exhibits, irrigation by pumps and *dons* and *gur* making and ploughing.
8	Sekeddah Agricultural Show (Birbhum).	7th to 13th January 1915.	Nil.	Superintendent of Agriculture, Burdwan Division.	Departmental exhibits, seeds, manures and implements recommended by the Department.
9	Mahata Mela (Burdwan)	15th to 18th January 1915.	Nil.	Ditto, ditto ...	Departmental exhibits.
10	Shib Sanker Jhi's Art and Agricultural Exhibition, Serampore (Hooghly).	10th February 1915.	Nil.	Ditto, ditto ...	Ditto.
	DACCA DIVISION.				
11	Agricultural and Cattle Show at Char handakola in the Khasmahal of Janajat (Faridpur).	29th to 31st January 1915.	200	District Agricultural Officer and Fieldmen Demonstrators.	(1) Demonstration of Planet Junior hand-hoe. (2) Demonstration of Meston plough. (3) Field demonstration that potato can be grown with success. (4) Showing how cattle can be better housed and manure better conserved.

Serial No.	NAME OF FAIR AND LOCALITY.	Dates on which the exhibition was held.	Amount contributed by the Agricultural Department.	Officers of the Department who attended or helped in the Agricultural shows.	Exhibits sent and demonstrations given by the Department.
1	2	3	4	5	6
			Rs.		
12	Baliakandi Agricultural Show (Faridpur).	7th and 8th February 1915.	200	District Agricultural Officers and Fieldmen Demonstrators.	(1) Demonstration of Planet Junior hand-hoe. (2) Demonstration of Meston plough. (3) Field demonstration that potato can be grown with success. (4) Showing how cattle can be better housed and manure better conserved.
13	Bhanga Agricultural Show, Faridpur, and Potato Exhibition.	21st March 1915	250	Deputy Director of Agriculture, Superintendent of Agriculture, District Agricultural Officer, Fieldmen Demonstrators.	Ditto. ditto.
14	Potato Exhibition at Dacca.	28th March 1915	200	Deputy Director of Agriculture, Superintendent of Agriculture and District Agricultural Officer and Fieldmen Demonstrators.	No other exhibits were sent.
15	Potato Exhibition at Mymensingh.	31st March 1915	200	Director of Agriculture, Deputy Director of Agriculture, Superintendent of Agriculture and District Agricultural Officer and Fieldmen Demonstrators.	
16	Potato Exhibition at Barisal.	30th March 1915	200	District Agricultural Officer and Fieldmen Demonstrators.	
	CHITTAGONG DIVISION.				
17	Feni Agricultural Exhibition (Noakhali).	22nd January 1915 and fortnight after.	100	First Deputy Director of Agriculture and two Fieldmen Demonstrators.	Departmental exhibits, seeds, manure, and implements recommended by the Department.
18	Agricultural Exhibition Ruposdi, Brahmanbaria Subdivision (Tippera).	27th February 1915 and three following days.	200	Superintendents of Agriculture, Rangpur District and Chittagong Division, and Fieldmen Demonstrators.	Departmental exhibits.
19	Potato Exhibition, Harinarayanpur (Noakhali).	10th and 11th April 1915	100	Superintendent of Agriculture, Chittagong Division.	.....

APPENDIX II.

A list of Agricultural Implements and Machines which have been tested in Bengal during the year ending 30th June 1915, and of those in use which are reported to have met with success.

No.	Designation of implement.	Use.	Special advantage or instruction.	Price.	Where procurable.	Name and designation of reporting officer.	Opinion.	Extent to which used by agriculturists.
1	2	3	4	5	6	7	8	9
				Rs. A.				
1	Meston plough ...	Ploughing ...	Makes a deeper furrow than the country plough. It also makes a slight inversion of the soil.	5 8	Agricultural Department Seed Stores, Messrs. T. E. Thomson & Co. and Messrs. Burn & Co.	N. Gupta, sq., Superintendent of Agriculture, Rajshahi Division and A. P. Peters, Esq., Subdivisional Officer, Gaibanda.	Very useful on light soil.	Its use is being steadily extended among the cultivators.
2	Planet Junior hand-hoe.	Weeding and interculture of agricultural lands.	Saves manual labour. Portable and handy.	22 0	Messrs. Burn & Co., and Messrs. T. E. Thompson & Co.	J. N. Bose, Esq., Member, District Agricultural Association, 24-Paganas, B. C. Mazumdar, Esq., Secretary, Agricultural Association, Khulna, and Superintendent of Agriculture, Rangpur.	Although a very useful implement, the cultivators cannot afford to purchase it owing to high price.	Used to a limited extent.
3	Chain pump ...	Lifting water from wells for irrigating purposes.	Saves a good deal of manual labour. The mechanism is simple and can be worked by one or two men.	45 0 to 60 0	Ditto ...	Babu Rajram Mitra, Honorary Secretary, Bankura District Agricultural Association.	Ditto ...	Ditto.
4	Three roller sugarcane mill.	Extraction of juice from sugarcane.	One passing of the cane through this mill is sufficient to extract the juice to the fullest extent.	85 0	Messrs. Burn & Co.	J. C. Chaudhuri, Esq., Subdivisional Officer, Narail.	More useful and efficient than ordinary wooden mills.	At present used largely by the cultivators and much appreciated by them.
5	Iron *don*	Irrigating agricultural lands.	Cheap and lasting	9 8	Agricultural Department Seed Stores.	H. P. Mitra, Esq., Superintendent of Agriculture, Presidency Division.	Satisfactory ...	Used to a large extent.
6	Sibpur plough ...	Ploughing ...	Makes a deep furrow. Specially advantageous in dry soil.	9 0	Ditto ...	Babu Rajram Mitra, Honorary Secretary, Bankura District Agricultural Association.	Ditto ...	Used only for experimental purposes. The cultivators are not accustomed to work with it.
7	Hand cultivator ...	Interculture of agricultural lands.	Saves manual labour.	14 0	Messrs. Burn & Co.	R. C. Das, Esq., Manager, Kasimbazar Wards' Estate, Rangpur and Superintendent of Agriculture, Rangpur.	Very useful ...	Used to a limited extent.
8	Knapsack's sprayer	For applying Bordeaux mixture, etc., to plants.	Labour saving ...	60 0	Messrs. T. E. Thomson & Co.	Superintendent of Agriculture, Rangpur Farm.	An effective contrivance for applying insecticides and fungicides.	Used by this Department in cultivators' lands. None has so far been purchased by private individuals.
9	Punjab plough ...	Ploughing ...	Inverts the soil. Ploughs to a depth from 6 to 9 inches.	35 0	Messrs. Octavius Steel & Co., Ld., Calcutta.	Babu Santi Prosad Sen Gupta, District Agricultural Officer, Mymensingh.	Works well on all sorts of soil, but requires a strong pair of bullocks.	Very limited.
10	Spring teeth harrow.	Hoeing and harrowing.	Saves manual labour.	25 0	Messrs. Leslie & Co., Calcutta.	Ditto ...	Suitable for light soils only.	Ditto.

B. S. Press—3-11-1915—2054J—850—C. S. M.

REVENUE DEPARTMENT.

AGRICULTURE.

CALCUTTA, THE 20TH DECEMBER 1915.

RESOLUTION—No. 12480Agri.

READ—

The Report of the Department of Agriculture, Bengal, for the year ending the 30th June 1915.

Staff.—Mr. J. R. Blackwood, I.C.S., was in charge of the department throughout the year. Mr. K. McLean, who was selected for the newly sanctioned post of Second Deputy Director of Agriculture, Bengal, arrived in India on the 28th October 1914, and after three months' training at Pusa, joined at Dacca on the 29th January 1915, and was placed in charge of the farms (with the exception of Kalimpong Farm) and of demonstration work in the Dacca, Chittagong and Rajshahi Divisions. Mr. F. Smith, who worked as Deputy Director of Agriculture for the whole province up to 29th January 1915, was, after the arrival of Mr. McLean, put in charge of the demonstration work and farms in the two divisions of West Bengal, together with the farm at Kalimpong. Messrs. H. E. Annett and G. P. Hector continued to work as Agricultural Chemist and Economic Botanist, respectively, throughout the year, and Mr. R. S. Finlow returned from leave on the 29th July 1914 and resumed the duties of Fibre Expert.

The development of the department demands a further increase in the superior controlling staff and the appointment of a Third Deputy Director of Agriculture, but like other new schemes this will have to await an improvement in the financial situation.

As observed in the last year's Resolution, the sanctioned cadre of the Provincial and Subordinate Agricultural Services is a tentative one, providing for the immediate requirements of the department. Experience has established the necessity of revising the scheme, and the Governor in Council is considering, in consultation with the Director of Agriculture, on what lines the revision should be effected. There is now a Superintendent of Agriculture for each division, and there are ten district agricultural officers.

2. *Agricultural education.*—Only five students from Bengal appeared at the Diploma Examination of the Sabour Agricultural College held in March 1915. Of the four students who obtained diplomas, two have secured appointments under the Government of Bihar and Orissa as supernumerary agriculturists, and another has been given a temporary appointment in this province. The number of Bengal students in the first, second and third year classes of the college are 8, 3 and 2, respectively. One student who was sent to Pusa in 1914 has completed his training in agriculture and has now taken up the mycological course. A new scholarship of Rs. 30 for two years was sanctioned during the year under report, but it is vacant as the candidate selected failed to join at the last moment.

The scheme for giving a short course of practical training in scientific agriculture on the Dacca Farm to the sons of zamindars, noticed in the last Resolution, has met with the approval of the East Bengal Landholders' Association, but has not evoked much interest elsewhere. The Governor in Council is now considering the scheme in fuller detail, but this is another scheme which will have to wait for better times.

Rules relating to the duties of fieldmen-demonstrators were issued during the year under report. These rules provide that a demonstrator will undergo training on an agricultural farm for a year, during which he will receive instruction in all ordinary agricultural operations as well as practical training in demonstration work.

The report on the result of the "Nature Study," which forms part of the curriculum of primary schools, is far from encouraging. The Governor in Council is, however, glad to notice that the matter was discussed at a conference held at Rangpur with the Director of Public Instruction, and that some teachers of guru-training and circle schools have returned to their schools after receiving some training in the subject at the Dacca Training College. His Excellency in Council, while awaiting the result of this training, desires that the Director of Agriculture should keep himself in close communication with the Director of Public Instruction on the subject. There is material for the study and observation of nature by children in the diverse

trees and crops of the Presidency, which can be made use of without artificial appliances if the teachers know how to go about their work, and the absence of appliances should not retard the use of these objects.

3. *Research and experiment at agricultural stations.*—The reports of the scientific officers of the department have, since last year, been published in a separate volume, a summary being given in the general report of the department. The Fibre Expert concentrated his attention on the important question of jute seed selection. At the beginning of the present season he had enough seed of his "pure-line culture" to sow about 1,000 acres, but the demand for improved seed has not been as much as was expected. Comparison is being made, in many places, between Mr. Finlow's selected seed and the raiyats' seed, and the result is being carefully watched. It will be necessary to establish a marked superiority of the "pure-line culture" seed over the seed used by the raiyats before a keen demand can be expected. The Governor in Council observes that on the Rajshahi Farm the *capsularis* or East Bengal jute gave an outturn of 8⅓ maunds per acre, compared with 19½ maunds obtained from *olitorius* which is ordinarily grown in the Rajshahi Division, a result which emphasizes the need for separate consideration of the best seed for each distinct tract. Mr. Finlow also continued his investigations into the manuring of jute. Particular attention was given to the acid red soils of the Dacca Farm, and it has been definitely proved that lime and bonemeal, together with cowdung, produce a marked increase not only in the outturn of jute but also of a crop of mustard following it. The Governor in Council is glad to see that Mr. Finlow has during this season applied bonemeal and lime to the raiyats' fields. Successful results obtained in the raiyats' fields are likely to carry more conviction with the public than results obtained in the farms. The recommendations made by the Board of Agriculture in 1911 in regard to the sugar industry are being closely followed. Mr. Annett, the Agricultural Chemist, has been carrying on experiments with certain varieties of sugarcane on the Dacca Farm and some encouraging results have been obtained. With a view to surveying the canes grown in this province 14 varieties were tried last year at the Dacca Farm. This year 44 other varieties from different districts have been added to the number. It is hoped that all the varieties grown in this Presidency will soon have been collected, studied and classified. The importance of the sugar industry has increased since the outbreak of the European war, and the Agricultural Department has taken steps to encourage the re-establishment of the industry of producing sugar from the date-palm. Owing to the competition of imported sugar a consideraale number of trees have in recent years been left untapped. Mr. Annett, who has made a special study of the subject, made a tour of the central districts of the Presidency in order to examine the situation and to advise district officers and persons interested in the industry as to the action to be taken for increasing the outturn of date-sugar. A small apparatus is being imported from America for the production of maple-sugar. This plant will deal rapidly with the juice of a large number of date trees. Mr. Hector, the Economic Botanist, completed the survey of the transplanted *aman* paddy of East Bengal and began testing several kinds on a practical scale. One of the varieties was tried both on the Dacca Farm and in the neighbouring cultivators' fields, and very hopeful results followed. Attempts to devise some means of combating the *ufra* disease of rice were continued in the Noakhali and the Dacca districts, but no definite results have been obtained. Though it is doubtful whether any kind of paddy is immune from the disease, some varieties appear more likely to escape than others owing to their ripening early in the season before the attacks of *ufra* become virulent. This disease is a source of serious loss and requires unremitting attention. On the minor farms experimental work has been carried out mainly in connection with jute, paddy and sugarcane.

4. *Rangpur Dairy Farm.*—This farm was started with the object of improving the breed of indigenous cattle. Subsidiary objects in view are to demonstrate the possibilities of mixed farming, and to prove that dairy farming can be conducted at a profit.

The method which has been adopted is to collect cows of different kinds from various parts of the Presidency and to keep a careful record of their milk yields with a view to multiplying the species which give the best yields. This method has been subjected to criticism as not having in view the establishment of a fixed type. In its favour it has been urged that

there is no indigenous breed of cattle in Bengal, but that the supply is kept up by importing animals from elsewhere, that owing to climate and a bad system of cattle management a superior race of cattle will not thrive in Bengal under present conditions, and that the best prospect of success is to be looked for in selecting from animals which have best been able to withstand their environment. The farm has recently been visited by His Excellency, and the subject of the future policy is under consideration. There are now 111 cows at the farm, and in some cases satisfactory yields of milk have been recorded. The cultivation of sugarcane is being extended, and with the provision of an engine for crushing the cane it is expected that the farm will prove financially profitable.

5. *Agricultural associations.*—The Director's report enumerates the demonstrations undertaken by the members of the several divisional and district agricultural associations. The success of these demonstrations was limited in many cases by want of rain in September and October. The Governor in Council takes this opportunity of recording his appreciation of the efforts of the members to bring before their countrymen the advantages of selected seed and improved methods.

6. *Demonstrations conducted by the department.*—There has been a considerable expansion of the demonstrating staff, and steady progress has been made in all the main items of demonstrations, viz., the effect of bonemeal on paddy and jute, the introduction of superior varieties of seed, seed selection, conservation of cowdung, the use of improved agricultural implements, and growing of *dhaincha*, sunnhemp and cow-peas as a green manure. The purchase of bonemeal manure by co-operative societies for the use of the members constitutes an important feature in the year's work, and the Governor in Council desires that every effort should be made to show to members of co-operative societies, both in the farms and in the fields of raiyats, the results obtained by the Agricultural Department. A co-operative society not only affords means for dissemination of knowledge among a large number of people, but also enable raiyats to make use of improved methods by advancing the money, without which the increased expenditure would in many cases be an insurmountable obstacle.

7. *Sericulture.*—During the year under report the Director of Agriculture submitted a revised scheme for saving the silk industry in Bengal. The original scheme was to supply all the seed cocoons necessary for the province from Government nurseries with a view to eliminate disease, and it was estimated that 19 central Government nurseries, with seven rearing-houses in each, would be required for the purpose. In pursuance of the scheme, seven such central nurseries have already been established. A census of mulberry fields which was taken during the year, however, showed that 22 central nurseries would be required to meet the needs of the whole province. In consideration of the heavy cost of the scheme and in view of the fact that the Governments of France, Italy, Japan and China do not supply the entire seed required, but that the principal quantity is supplied in those countries through professional rearers working under Government supervision, the Director of Agriculture has proposed in his revised scheme that only one-third of the total demand should be reared in Government nurseries and that the remainder should be reared by selected professional rearers under the supervision of the Agriculture Department. The whole question of the future policy in aiding the silk industry is held in abeyance pending the result of the enquiries now being conducted by Mr. H. M. Lefroy, the Imperial Silk Specialist. The causes underlying the decline of this industry are, however, probably more deep-seated than the want of healthy seed cocoons, and include the ousting of mulberry by crops which have increased in value, the appearance of substitutes for silk, and the defects in the indigenous methods of rearing.

The hybridising experiments, which were being carried on by M. E. Grangeon before he left for military duty in France, are being continued by Mr. P. C. Chaudhuri, Superintendent of the Berhampore Central Nursery. These experiments as well as those conducted by Miss Cleghorn are reported to give promise of successful results. It is satisfactory to notice that two students of the sericultural class attached to the Berhampore Central Nursery, after having passed the final examination, have constructed model rearing houses with the money they received as rewards and have started rearing on scientific lines.

8. *Fisheries.*—During the year under report, Mr. T. Southwell, the Deputy Director of Fisheries, has drawn up an interesting note under the title "Report on Fishery Investigations in Bengal, and Bihar and Orissa, with recommendations for future work." The note, which has been published as Bulletin No. 5 of the Fishery Department, contains a very clear statement of the progress hitherto made in the department as well as a full programme of future work. Mr. Southwell's work during the past four years has mainly been confined to a comprehensive survey of the fishery problems of the two provinces, and is now reaching a stage at which valuable results are likely to be obtained. The principal part of the work done hitherto has been in connection with carp and *hilsa*, and the main lines on which definite improvements are expected are—increasing the supply of fish by artificial cultivation, preserving the existing supply of fish by preventing practices which tend to diminish it, and improving the organization of the fishery industry by introducing co-operation among fishermen and removing obstacles which hinder the industry. Now that the department has been provided with a steam-launch, Mr. Southwell will be able to study effectively the problem of the breeding grounds of *hilsa* and to begin the work of a systematic survey of the fisheries of the Sundarbans. Mr. Southwell's investigations have brought to notice the unsatisfactory conditions under which fishermen carry on their industry and the extent to which the profits are absorbed by middlemen, to the detriment alike of the fishermen and of the public. Measures are being taken for establishing co-operative societies among fishermen, and though rapid progress cannot be expected, the scheme is one which affords prospects of beneficial results. The statistics of the import of fish into Calcutta showed a large decrease, which is probably due, in part, to greater consumption in the neighbourhood of the fisheries.

9. *The jute forecast.*—The year under report is the fourth year in which the jute forecast has been based on a detailed census prepared by panchayats of the area under jute cultivation in each union. The experience which has been gained by the panchayats and by the officers engaged in checking the returns is believed to have assisted materially in the elimination of error as regards area, and continued crop-cutting experiments have led to more accurate estimation of outturn. The Governor in Council is satisfied that the jute forecasts now afford a substantially accurate estimate of the crop. The improvements, which have been effected in this important subject, are the results of Mr. Blackwood's efforts, and the Governor in Council has pleasure in acknowledging their value.

The checking of the forecast imposes heavy labour on the staff of the department at a time of the year when agricultural operations are at their busiest, and the Governor in Council recognizes that the time spent on the forecast is lost to purely agricultural work. Under present financial conditions it is not practicable to increase the establishment, but the question of a redistribution of work on the lines which will involve the least possible interference with purely agricultural work is under consideration.

By order of the Governor in Council,

L. BIRLEY,
Offg. Secretary to the Govt. of Bengal.

No. 12598.

COPY forwarded to the Director of Agriculture, Bengal, for information.

No. 12599.

COPY forwarded to the Registrar, Co-operative Societies, Bengal, for information, with reference to paragraphs 6 and 8 of the Resolution.

By order of the Governor in Council,

J. N. MITRA,
Under-Secretary to the Govt. of Bengal.

CALCUTTA,
The 20th December 1915.

B. S. Press.—7-1-1916—5694C—1,068—J. L. C.

REPORT

OF THE

AGRICULTURAL DEPARTMENT,

BENGAL,

FOR THE

YEAR ENDING 30TH JUNE 1916.

CALCUTTA:

BENGAL SECRETARIAT BOOK DEPÔT.

1916.

Published at the Bengal Secretariat Book Depot,
Writers' Buildings, Calcutta.

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DEPARTMENT OF AGRICULTURE, BENGAL.

No. 8570 A.

FROM S. MILLIGAN, ESQ., M.A., B.Sc.,
Officiating Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

Dated Calcutta, the 17th November 1916.

SIR,

I HAVE the honour to submit the Annual Report of this Department for the year ending 30th June 1916.

The reports of the expert officers have been published separately as in previous years.

I have the honour to be,
SIR,
Your most obedient servant,

S. MILLIGAN,
Offg. Director of Agriculture, Bengal.

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ANNUAL REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

FOR THE

YEAR ENDING 30TH JUNE 1916.

Administration.

THE following branches are under the administrative control of the Director of Agriculture :—

I.—Veterinary Department.
II.—Agricultural Department.
III.—Fisheries.
IV.—Sericulture and Weaving.

The report of the Veterinary Department has been submitted separately.

2. Mr. J. R. Blackwood, I.C.S., held the post of the Director of the department up to 9th June last, on which date I took over charge from him. Mr. D. N. Mookerji continued to work as Personal Assistant to the Director throughout the year. Mr. Blackwood spent 135 days on tour during the year. This includes a week at Pusa in connection with the meeting of the Board of Agriculture held there in February last which was also attended by Messrs. Finlow, Annett and McLean. All the agricultural farms and sericultural nurseries under the department were inspected.

3. Messrs. F. Smith and Kenneth McLean, the present Deputy Directors of Agriculture, continued to hold charge of the agricultural operations in West Bengal and East Bengal, respectively, as in the previous year. In order to cope with the increase of work the appointment of a third Deputy Director of Agriculture is under consideration. Mr. Smith was on privilege leave from 14th August to 11th October 1915, when Mr. McLean performed his work in addition to his own duties. Messrs. R. S. Finlow and H. E. Annett worked as Fibre Expert and Agricultural Chemist, respectively, throughout the year. Mr. G. P. Hector worked as Economic Botanist till 3rd May 1916 when he went on long leave. Mr. Finlow has been in charge of his work in addition to his own duties as Fibre Expert.

There was no change during the year under report so far as the Provincial Service was concerned, the demonstration work in each division being in charge of a Superintendent of Agriculture. Mr. J. N. Sarkar was the Superintendent of the Burdwan Division, Mr. H. P. Mitra, of the Presidency Division, Babu Rajeswar Das Gupta and Messrs. N. Gupta and Dwija Das Dutt were in charge of the Dacca, Rajshahi and Chittagong Divisions, respectively, as in the previous year. Mr. J. N. Chakravarty was in charge of the Dairy Farm at Rangpur. He also exercised general

control over the other two Agricultural Stations in the district (viz., Burirhat Farm and the Rangpur Demonstration Farm), as well as over the demonstration work of the Rangpur district, till 31st March last.

A Farm Superintendent was in charge of each of the agricultural stations at Chinsura, Dacca, Rajshahi and Burirhat, and an Overseer was in charge of the Demonstration Farm at Rangpur. A District Agricultural Officer was posted at Dacca, Faridpur, Mymensingh, Bakarganj, Rangpur, Pabna, Malda, 24-Parganas, Birbhum and Bankura. The number of Fieldmen Demonstrators was reduced from 75 to 62 during the year. The present staff of demonstrators is now mainly composed of men belonging to the cultivating class. The original proposal that the subordinate staff should be increased so as to ultimately provide an agricultural officer for each district and a demonstrator for each thana has been kept in abeyance pending the appointment of the necessary expert staff in the superior service. Babu P. C. Sen, Babu A. L. Some and Mr. N. N. Pillai continued to work as Entomological Collector, Mycological Collector and Weaving Master, respectively, throughout the year.

With a view to facilitate the distribution of approved seed, manures and implements, seed stores have been established in each division under the Divisional Superintendent of Agriculture. In addition to the five divisional seed stores, branch stores have been opened at Mymensingh, Faridpur and Barisal, each under the local District Agricultural Officer and on branch store has been established at Nator under the local demonstrator. Another seed store with an Overseer in charge has been attached to the Dacca Farm.

4. Tours.—During the year Mr. Smith spent 124 days in inspecting the Chinsura, Burdwan and Kalimpong farms and also in visiting the demonstration plots in almost every district in Western Bengal. Mr. McLean, Deputy Director of Agriculture, Eastern Bengal, spent 190 days in visiting all the agricultural stations under him as well as the demonstration areas in his circle. Mr. Hector, Economic Botanist, spent 67 days on tour in visiting the Chinsura, Burdwan, Rajshahi and Rangpur farms in Bengal and the Karimganj Farm in Sylhet as well as Mymensingh and Chittagong districts and the Bikrampur side of the Dacca District. His Assistant visited the Garo and Chittagong Hill Tracts with the Assistant to the Imperial Cotton Specialist to help the latter in obtaining information regarding the varieties of cotton and the methods of cultivation in those places. Mr. Annett, Agricultural Chemist, was on tour for 111 days during the year. He carried on his sugarcane experiments at the Chinsura and Rajshahi farms. Frequent visits were paid to Kotchandpur in the district of Jessore in connection with palm-sugar industry, where experiments were commenced in improving the manufacture of palm-sugar. He also examined the students of the Agricultural College at Nagpur.

The Fibre Expert spent 164 days on tour. The tours were mostly undertaken for the inspection of jute plots. Bihar was also visited to make arrangements for the propagation of his selected jute seed. Lyallpur in the Punjab was visited in May 1916 to discuss the Punjab programme for experimental cultivation of fibres. The Superintendents of Agriculture and also the touring officers in the subordinate service, viz., the District Agricultural Officers, the Entomological and Mycological Collectors and Weaving Master spent a considerable portion of their time on tour.

SECTION I.

1.—Agricultural Education.

5. The Principal of the Agricultural College, Sabour, reports that, on the 30th June 1916, there were 20 Bengal students on the roll of the College—2 in the third year, 6 in the second year and 12 in the first year class. Two students were successful in the Diploma Examination held in March 1916. One of them has been appointed temporarily under the Government of Bihar and Orissa as a Supernumerary Agriculturist and deputed to the Sabour Farm for training. The other, it is believed, has enlisted. Three of

the Bengal students joined the Bengal Ambulance Corps. It is satisfactory to note that most of the scholarships awarded by private gentlemen and District Boards for proficiency were held by Bengal students during the year.

The student, who was reported last year as having joined the Mycological course at Pusa, completed his course in May last.

Nature study in Primary Schools.—It appears from the report of the educational authorities that, although in certain parts the number of trained teachers is increasing and steps are being taken for a systematic study of the subject no satisfactory progress can be said to have been made in this direction. This is ascribed mainly to the want of a sufficient teaching staff.

2.—Research and Experiment.

6. The activities of the Agricultural Branch of the Department are concerned mainly with the improvement of the existing crops of the Presidency. It may be stated generally that the improvement of any particular crop can be effected by—

(1) an improvement in the efficiency of the individual plants in the direction of the ultimate product aimed at, whether seed, fibre, sugar etc.;

(2) an improvement in the soil conditions under which the crop is grown, *e.g.*, in the increase of the available plant food of the kind required for the crop, the maintenance of favourable soil moisture conditions, etc.

(3) the reduction of inimical forces, such as plant diseases, insect attacks, etc.

It will thus be understood that a great deal of the seemingly unconnected work at the Agricultural stations and at the Research Laboratories at Dacca has nothing more or less in view than the ultimate improvement of one or other of the staple crops of the Presidency. For the sake, therefore, of giving a connected account of the work of the department it seems advisable to do so by reference to the particular crops involved showing in what directions and to what extent the department has been successful in improving them and indicating the lines on which development is to be expected. Special lines of work such as cattle-breeding, etc., will be treated separately.

7. Rice.—The rices of the Province can be roughly grouped into three main types, having distinct agricultural characters :—

(1) Aus paddy occupying the higher land and sown as a dry crop.

(2) Transplanted aman occupying a lower, but not the lowest, land.

(3) Deep-water or bhil aman sown early and having the agricultural character of being able to grow sufficiently rapidly to avoid total *immersion.*

The transplanted aman is the more important crop occupying, as it does, the largest area and giving higher acreage outturns.

The aus varieties come next in importance.

Botanical work on rice.—Since the appointment of Mr. Hector to the post of Economic Botanist at Dacca the improvement of the varieties of aus and transplanted aman paddy has received detailed attention. Some thousands of varieties obtained from the paddy fields of Bengal and differing from each other in botanical and agricultural characters have come under observation and have been tested with reference to their economic qualities. From these Mr. Hector has succeeded in isolating and multiplying several excellent types of the transplanted aman variety, one of which has been selected and tested against the best obtainable local varieties in several districts. The trials of this variety both on the Government farms and outside have been very satisfactory, showing a large increase over the local varieties.

If any confirmation of the high yielding power of this variety were necessary, it is to be found in the demand for seed from the immediate vicinity of the Dacca Farm. This year 700 maunds (about 26 tons) of seed enough to sow 2,000 acres has been issued to neighbouring cultivators, the produce of which about 50,000 maunds (about 1,840 tons) will be available for further propagation. With regard to the *aus* and deep-water paddy varieties, the work is progressing satisfactorily, but further tests are necessary and it will probably be a few years before a final selection for distribution can be made.

Mention should also be made of the cross breeding experiments in progress at Dacca, where Mr. Hector has succeeded in demonstrating that many of the differentiating characters of rice are inherited on Mendelian lines. The results of part of this work are being published as a Botanical Memoir.

Agricultural work on Rice at the Experimental Stations.—The experiments under this heading have been mainly directed towards the testing of different varieties of rice under the different local conditions represented by the agricultural stations. It is worthy of note that the Dacca No. 1 aman paddy has given positive results at Dacca, Rangpur and Rajshahi. This is important as it demonstrates the suitability of this variety to both Eastern and Northern Bengal and indicates the magnitude of the area, over which a successful seed distribution is possible. At Chinsura this variety where grown on a small scale equalled the best local varieties. On a larger scale, however, the Farm Report shows that the local variety *Nagra* proved more paying. I am, however, not satisfied that the results here shown justify the conclusion as to the superiority of the local variety, as it received the benefit of a considerable application of capital in the form of manure, etc., the return to which has been by separate experiment shown to be at least equal to the difference in the profits shown against each of the two crops. The results at Chinsura may therefore be considered indecisive, although it is unlikely that the same variety will suit the totally different conditions of Eastern and Western Bengal.

Aus paddy.—The study of aus varieties is practically confined to the Dacca Experimental Station and there is nothing new to record in this year's work. It is to be hoped that Mr. Hector may be as successful in his treatment of this important crop as he has been with the aman varieties.

Manures for rice.—The study of the economic use of manures for the rice crop has been continued at the Agricultural Stations. The experience of this year tends to confirm that of previous years. On the Dacca red soil it has been found that bone-meal used without lime gives better results on rice than when used with lime. This is contrary to the experience with the same manure on jute and on the *rabi* crops, especially mustard. Mr. Smith continues to obtain good results from the use of green manures, bone-meal, etc., at Chinsura and Burdwan and is able to show increases of up to 10 and 11 maunds of grain per acre over unmanured plots. There still remains, however, a great deal of quantitative work to be done regarding the use of manures.

Seed rates.—The work carried on by the Economic Botanist on the specific gravity method of selection, although indecisive regarding the main object of the investigation, again shows clearly the economy of lower seed rates. The Chinsura results also indicate that a considerable saving of seed both in the seed bed and at the time of transplantation can be effected. This has been the general experience of the Agricultural Departments all over India. It would thus appear that in the aggregate a large amount of potential food is annually wasted in the seeding of the rice crop.

Ufra disease of rice.—A survey of the ufra-infected districts has been undertaken to ascertain the progress of the disease. It is reported to be slowly spreading. The researches at Pusa confirm the experience of previous years regarding the cause of the disease which is due to the attack of the minute worm "Tylenchus angustus." Some further information has been obtained regarding the habits and biology of the pest. The Imperial Mycologist is of opinion that the thorough burning of the rice stubbles after harvest will save the subsequent crop.

This year experiments were undertaken by the Collectors of Dacca, Noakhali and Tippera under the guidance of the Agricultural Department, The experiments consist of collecting and burning the stubbles on a fairly large area which is protected from outside infection by embankments. Meanwhile all indications point to the fact that the disease can be mitigated by stubble-burning and there appears to be no reason why the information should be withheld from the people especially as it is a matter which they can deal with themselves. Arrangements are being made therefore to spread the information as widely as possible and to offer all the assistance we can. It seems improbable that the people of the badly-affected areas will refuse to listen to advice and help if properly tendered. The examination of the deep-water paddies with a view to discovering a variety with a sufficiently early ripening habit to avoid the worst attack of the disease is being continued. This is an important line of work. If an earlier ripening of the crop proves a successful method of avoiding the disease, it is possible that this can be further assisted by the use of phosphates, the action of which on the ripening of cereals is well known.

8. Jute.—Work on jute is conducted on all the Government farms in the Presidency except on the Tobacco Farm at Burirhat. The botanical work is controlled by the Fibre Expert, who also advises generally regarding the manurial and other experiments at the agricultural stations.

Selection.—Selection and cross-breeding experiments are being conducted at Dacca as a centre for the *capsularis* varieties, while the *olitorious* varieties are being studied at Chinsura. It has now been established that Mr. Finlow's pure line selection Kakya Bombai No. 7 is a heavier yielder than any of the local varieties. Attempts are being made through a widespread series of test plots to find out the localities suitable for this variety and it is expected that valuable information on this point will be forthcoming this year. Some of these localities have already been indicated by an increased demand for seed of this variety.

During the year under review 150 maunds (12,000 lbs.) of seed sufficient to sow 1,500 acres have been sold, and 28,000 lbs. (sufficient to sow 3,500 acres), provided for next year's sowings has already been practically booked up. The problem of providing for a further increase in the demand and of organizing a general distribution scheme in the areas suited to the growing of this variety is under consideration. The assistance offered and given by the jute firms mentioned in Mr. Finlow's report has been of the greatest value. With their extensive trade ramifications they will doubtless prove of the utmost assistance as a distributing agency for improved seed.

Olitorious or Desi Jute.—Western Bengal, owing to the absence of pre-monsoon rainfall, demands a quick-growing variety of jute. Selections from the *olitorious* or *desi* varieties appear to offer more immediate prospects of success than from the slower-growing *capsularis* of Eastern and Northern Bengal. Work on these lines has therefore been started under the supervision of Mr. Finlow at Chinsura. It is not unlikely that, as with the jute of Eastern Bengal, considerable differences in yield of fibre will be found between the various varieties and between individuals of the same variety. This is from one point of view the more likely to be the case with a fibre crop than with a grain crop, as we have no evidence to prove that heavy fibre yielders are necessarily the best seed-producers, and in a country where selection is the exception and not the rule the probabilities are that the predominating varieties are simply those producing the largest number of seeds per unit of area.

Manures for Jute.—Previous year's experiments on the manuring of jute have been continued. These, however, are of too general a nature to throw much light on the special requirements of this crop. An exception, however, must be made in the case of the experiments at Dacca, where the qualitative results from the use of potash have been clearly demonstrated. It remains to be seen, however, whether the results attained are applicable to soils outside the laterite formation represented by the Dacca Agricultural Station. The results, however, are very striking, the potash plots showing a considerable increase in the thickness of the stems and in addition being much healthier all over. There are thus indications that a more system-

atic and scientific treatment of the subject of manuring will lead to valuable results. From a general point of view no crop in the Presidency ought to give better economic returns to manuring than jute, the upper limit of the outturn of the crop being very high. Already plots up to 34 maunds (2,788 lbs.) of fibre per acre have been weighed at the Dacca Farm on land on which some years ago the Fibre Expert had to content himself with 10 maunds (820 lbs.).

Water weeds as a source of manure.—Experiments with dressings of manure obtained from the water hyacinth in the form of (*a*) rotted plant and (*b*) ash, have been conducted at Dacca. The ash of this plant contains nearly 30 per cent. of potash and in conformity with the results obtained with potash salts on jute, both the ash and the rotted plant have been found to be excellent manures. In order to produce definite qualitative results large applications were made. Pending quantitative measurements, a final opinion must be reserved, but there appears to be no doubt that a new potential source of manure for jute has been discovered in the water hyacinth.

Cultural improvement of the jute crop.—Apart from the production of higher fibre yielding varieties and the use of manures there appears to be some room for the improvement of the crop from an agricultural point of view.

It is generally recognised that a fine seed bed and the thorough weeding and thinning of the crop after germination are of the first importance. There is no doubt whatever that the existing equipment of the cultivator in the way of implements could, with advantage, be added to by the use of some of the lighter class of Western implements. I therefore attach considerable importance to the use on the Dacca Agricultural Station of light implements such as spring tyned harrows, etc., which are of the greatest value in preparing the seed bed.

It is also to be observed that in no modern cultivation would a valuable and important crop like jute be sown broadcast. The preservation of correct spacings and the necessity of thorough weeding demands the drilling of the seed in lines. This question, I am glad to say, has been taken up at Dacca and I feel confident that not only will more satisfactory experimental results be obtained but that the improved methods will prove economically sound.

9. **Tobacco.**—The improvement of this crop is being worked out at the Burirhat Farm, Rangpur.

Experimental work falls under four main heads.

(1) The growing of Sumatra tobacco for cigar wrappers.

(2) Selective work on local tobaccos.

(3) The examination of outside varieties.

(4) Manurial experiments.

The price of the Sumatra leaf was this year adversely affected by the war, but values have to a great extent recovered. The financial return from this variety is much greater than from local varieties and provided there is a sufficient demand for a large quantity the experiment is promising. Regarding selection work there is not much to be recorded. Like similar work time is required to arrive at any decision regarding the respective merits of the varieties examined. The successful introduction of a green manure such as cowpeas into the tobacco tracts cannot fail to add to the crop outturn, and it is satisfactory to note that this practice is being demonstrated in the district.

10. **Sugarcane.**—This crop is grown at all the agricultural stations except Burirhat. Experiments have been mostly varietal in character.

At Dacca the two Barbadoes canes Nos. 208 and 147 continue to give good results, but Mr. Annett considers that the latter variety which has now been six years in the country shows signs of deterioration.

There is a considerable demand from cultivators in the vicinity of all the Agricultural Stations for the exotic varieties grown by us and the problem of organising the further propagation of these to meet an increase of demand will have to be faced. It is obvious that the supply available from Government farms would at its maximum be quite inadequate to meet any great demand.

11. **Palm sugar.**—Mr. Annett's investigations on date-palm sugar cover the whole process of *gur*-making from the collection of the juice to the refining of the sugar. The more important results obtained are—

(1) that the existing practice of smoking the pots as a means of preserving the juice is quite inefficient as far as the day juice is concerned, which as a consequence is practically wasted. Experiments in liming the pots, as is the custom in Madras, were completely successful, resulting in the almost perfect preservation of the day juice and a marked increase in the quality of the night juice.

(2) *Fuel experiments.*—Mr. Annett's investigations show that a great saving is possible in the amount of fuel necessary for *gur*-making through the use of fire bars and a chimney.

From the refiners' point of view the improvement in the quality of the *gur* from limed pots is of the first importance. The demonstrations of liming which have been arranged for the ensuing sugar-making season in Jessore should therefore create considerable interest to all concerned.

The refining of date-palm sugar is still carried on in the districts in the primitive manner common to most sugar-producing localities in India. Mr. Annett after an examination of the facts considers that centrifugalling will pay and proposes to give this method a trial.

The investigations into the causes of the dark colour characteristic of date-palm sugar are of considerable scientific interest, and the methods of improving the colour may yet be of great economic value to *gur*-makers in general.

12. **Seed distribution.**—This has hitherto been conducted on a small scale through District Agricultural Officers and Agricultural Associations, the chief item being potatoes. As mentioned above, a seed-store has been opened in each division for the retail of seeds, manures and implements. But such arrangements will soon prove inadequate for the real seed distribution problems that face the Department. To be really effective there must be some system on which improved seeds are distributed. A retailing of seeds in small quantities at divisional head-quarters will make little impression on the country side. How is the further propagation of an improved variety to be ensured once it leaves the agricultural stations? The chief difficulty lies in the danger of a considerable proportion of the produce of the first distribution not being kept for seed but being used for other purposes, *e.g.*, in the case of jute for fibre and in the case of rice for food. Owing, again, to the difficulties and expenses connected with storage and transport, centralization with its obvious advantages in the way of supervision appears to be out of the question. It appears therefore necessary that the distribution of the seed of the staple crops such as rice and jute should be on an extensive scale and that the number of distributing centres should be as large as possible so as to ensure a small unit of area per centre. With an efficient propagating agency 10,000 maunds (about 370 tons) of transplanted aman rice or 20,000 maunds (740 tons) of jute seed can be made to produce enough seed to sow 700,000 acres of each in the following season.

We have now one variety of each of these crops which can be recommended. It has been arranged with the Registrar, Co-operative Credit Societies, that his societies should be used to the fullest extent as a propagating agency for the seed. It is obvious, however, that this agency—an excellent one so far as it goes—will not for some years be in a position to cover the field sufficiently closely for our requirements and in some capacity or other the help of the people themselves will have to be enlisted. The Collectors of Dacca and Rangpur have already interested the presidents of the punchayats of their districts in the matter and it has been arranged to give this agency a trial in these two districts in the coming year. The demands on the presidents will not amount to much—simply to grow a small area under the selected seed and to see that the produce is distributed to villages in his jurisdiction in the following year. There will be no expense and there should be no loss as in case of failure to distribute all the seed there is always the open market for it, often a particularly good one at that time of the year. Owing also to the wideness of distribution existing storage accommodation will suffice.

3.—Cattle-breeding.

13. Departmental operations in cattle-breeding are confined to the Rangpur Dairy Farm. There is little to report on the year's work. The unfortunate outbreak of rinderpest was probably unavoidable under existing conditions. It is of interest to note that the Bengal-bred stock showed no greater disease-resisting qualities than those imported from Bihar.

A question of more importance is the future policy of this farm. It is apparent that the primary objects of its establishment are not likely to be attained on the present lines of working. For example, it is doubtful whether the necessary material for the production of a dual purpose animal exists in Bengal and it is probable that the milking quality will require to be introduced from other parts of India through milk pedigree sires. A close co-ordination with some general Imperial scheme for the improvement of Indian cattle on these lines thus appears to be necessary in order to make the local operations successful.

4.—Entomology.

14. The Imperial Entomologist has furnished a report showing the insect-pests sent to him from Bengal during the year. These were identified by him and remedial measures suggested where possible. He also gave much assistance in the identification of insects, preparing and supplying coloured plates and magic-lantern slides of injurious, beneficial and useful insects.

The Entomological Collector under the department also submits a report in which the chief items of his work during the year are mentioned.

He observed and treated the following crop pests on the Dacca Farm :—

Behar hairy caterpillar (Diacrisia obliqua, loc. "Bichhapoka").
Red spider (Telranychus sp.).
Rice case worm (Nymphula depunctalis).
Twelve-spotted Epilochma (Epilochma dodecostigma).
Mango shoot-borer (Alcides frenatus).
Jute semilooper (Cosmophila sabulifera, loc. "Chhatpoka").
Rice stem-borer (Schœnobius bipunctifer, loc. "Majrapoka").
Large brown cricket (Brachytrypes achatinus, loc. "Urchoonga").
Mothborer (Chilo sp. loc. "Majra").
Rice earcutting caterpillar (L. unipuncta, loc. "Chhenipoka").
Mustard Aphis (Aphis brassicæ loc. "Jabpoka").
Mustard saw fly (Athalia proxima).
Tobacco caterpillar (Prodinia littoralis).
The litchi mite (Eriophyes sp.)
Mango hopper (Indiocerus sp.).
Grain moth caterpillar (Sitotroga cerealella).
Indigo caterpillar (Caradrina exigua).

To check the ravages of the above insects fumigation, spraying, hand-picking, etc., were resorted to where possible.

5.—Mycology.

15. Dr. Butler, Imperial Mycologist, has furnished an interesting report on his work as far as it concerns Bengal, for which the thanks of the department are due. His principal work during the year was the continuation of the investigation of the "Ufra" disease of paddy in which he was assisted by our Mycological Collector. The disease has now been fully studied in the laboratory at Pusa and described in one of the Pusa Bulletins (No. 34 of 1913).

Amongst other works of the Imperial Mycologist may be mentioned—

(1) investigation of a disease of sal trees (Shorea robusta) in the forests of Buxa-Dooars. The disease proves to be a sort of root rot, resulting very often in a polyporous fructification on diseased trees just above the ground level, specimens of which have been identified at Kew as "Polyporous Shoreæ Wake," a species new to science;

(2) examination of certain samples of jute seed received from the Fibre Expert, in which the sclerotia of Rhizoctonia Solani Kühn were adhering to the seed. How the fungus found its way to the seed is still under investigation;

(3) investigation of a serious attack of gram rust from Jessore and potato disease caused by Fusarium Solani in Narayanganj, Cossimbazar and Rangpur.

The principal work of the Mycological Collector under the department consisted in assisting the Imperial Mycologist in connection with ufra. He made a survey of the ufra-infected tracts of the Dacca district with a view to obtain accurate information regarding the exact area over which the disease occurs in order to see whether it shows any tendency to spread and in what direction. The report on the survey has been submitted to the Imperial Mycologist. In addition to ufra work, several fungus diseases of paddy, betel-vine, potato and sugarcane were investigated.

6.—Agricultural Associations, Demonstrations and Shows.

16. **Agricultural Associations.**—In addition to the Provincial Agricultural Association there are 2 Divisional Associations, 13 District Associations and 5 Branch Associations as shown in the margin. The Provincial Association held one meeting during the year under report. The Divisional, the District and the Branch Associations had their meetings also, in several of which the officers of this department were present. A grant of Rs. 1,000 each was made as in previous years to the Burdwan and Presidency Divisional Associations, which they distributed among the different District Associations under them. Only 7 out of 38 members of the Burdwan Divisional Association carried out demonstration work with more or less success. The only members of the Presidency Divisional Association who undertook demonstration work during the year under report are Mr. M. M. Crawford of Shikarpur in Nadia, Raja Pramatha Bhusan Deva Rai Bahadur of Naldanga in Jessore, and Babu Tarak Nath Banerji of South Goria in the 24-Parganas. The Raja Bahadur reports that the general nature of the soil of that part of the country with which he is concerned is not suited to the potato cultivation which was undertaken by him by way of demonstration. The cost of labour and manure is rather excessive and it demands a good deal of attention which the people of the locality are not prepared to bestow. In spite of successful demonstration in his farm, he could not for this reason induce the tenantry to grow potatoes. Burdwan District Association distributed 10 maunds of bone-meal and some castor-cake to the poor cultivators for demonstration purposes. In order to popularise the use of bone-meal and the cultivation of groundnuts the Birbhum Association distributed 97½ maunds of bone-meal and 12¾ maunds of groundnut to the *bonâ-fide* cultivators at half price. The use of chain pump for irrigation purposes was appreciated by the members of the Bankura Association. Some of the members of the Burdwan, Birbhum and Bankura Associations undertook demonstration work, but for want of rain the results were not successful.

Divisional Associations.

1. Burdwan.
2. Presidency.

District Associations.

1. Burdwan.
2. Birbhum.
3. Bankura.
4. Hooghly.
5. Midnapore.
6. 24-Parganas.
7. Khulna.
8. Jessore.
9. Nadia.
10. Murshidabad.
11. Bogra.
12. Rangpore.
13. Malda

Branch Associations.

1. Kushtia. } In Nadia district.
2. Ranaghat. } In Nadia district.
3. Chuadanga. } In Nadia district.
4. Meherpur. } In Nadia district.
5. Rampur Hât in Birbhum district.

Rampur Hât Branch Association purchased some seeds of groundnut and cotton for distribution among the cultivators. Rai Lalit Mohan Singha Ray Bahadur of Chakdighi in Burdwan grew seven varieties of paddy and obtained 30 maunds of grain from *Kaminisal* variety with the application of cowdung at the rate of 120 maunds per acre. Babu Raj Narain Chandradharya of Maliara in Bankura tried *Puri* variety of sugarcane, and though his crop was damaged by "*tota*" insect, the outturn was satisfactory being 54 maunds of *gur* per acre. Babu Raja Ram Mitter of Gangajalghati in Bankura received an outturn of 13½ maunds of groundnut per acre without applying any manure. His paddy was not successful for want of timely rainfall and wheat and sugarcane were damaged by white ants. Babu Rama Prasanna Mukherji of Kundala in Birbhum secured an outturn of 225 maunds of Nainital potatoes and 25 maunds of *Dadkhani* paddy per acre using cowdung, castor-cake and pigeondung to the former and tank-silt to the latter. Very few members of the Hooghly Association undertook demonstration work. The tenants of Babu Karuna Nidhan Singh of Hooghly grew potatoes on char land without manure and irrigation, but the crop was not successful owing to drought. Babu Sriram Chandra Bose of Hooghly tried sugarcane, groundnut and potato. His potato was not successful on account of heavy downpour of rain during the sowing time, but his sugarcane manured with cowdung and oilcake was very successful. The canes grew 15 feet in length. Babu Basanta Kumar Mitra of Panisehala in Hooghly grew Nainital and Darjeeling potatoes on two plots of land measuring 2 bighas. The result obtained is satisfactory, being 171 maunds per acre on the whole. Babu Rampada Chatterji, Manager, Khas Mahal, Contai, and a member of the Midnapore Association, experimented with Raipur mustard and groundnut. He used bone-meal, castor-cake and dhaincha as manure, but none of these proved much of a success owing to the damage done to the crops by insects. Rai Sahib Abinash Chandra Bose of Pingla, another member of this Association carried out demonstration with Nainital potato seeds with tank silt as manure and obtained an outturn of over 100 maunds per acre. Raja Narendra Lal Khan of Narajole, Midnapur, was very successful in growing Italian potatoes and ginger, the outturn being 223 maunds and 120 maunds per acre. respectively. Babu Brojendra Kumar Ghosh, Sub-Manager of Government Estates, Kukrahati Circle, who is also a member of the Midnapore Association, tried Nainital potato, Patna pea and sugarcane. The outturn of potato, manured with nitrate of soda and superphosphate, was about 79 maunds per acre. For pea he used cowdung as manure and the outturn per acre was 6 maunds and 4 seers. His sugarcane was not successful as the plants were attacked by insects. Several members of the 24-Parganas District Association tried demonstration work with paddy, jute, potatoes and groundnut and some of them obtained satisfactory results, the most important being those of Babu Surendra Nath Ghosh of Rajibpur and Jitendra Nath Bose of Jamalpur, who obtained 39 maunds of paddy and 240 maunds of potatoes per acre, respectively. Khulna Association made demonstrations with jute, potato and English vegetables in its small farm. The outturn of jute per acre was about 34 maunds; potatoes and English vegetables were not successful. Babu Rajmohan Mukherji and Priya Nath Mukherji, members of the Jessore Association, obtained 60 maunds and 40 maunds of tobacco per acre respectively. The President of the Nadia District Association reports that the experiments conducted by its members were not successful in most of the cases due to drought. But the good results of castor-cake manuring have been demonstrated. Some of the members are still keen to carry on the demonstration work in jute, some kinds of paddy, potatoes, tobacco and *samshara* sugarcane. The work of the Branch Agricultural Associations has not yet been encouraging except at Chuadanga and to a lesser extent at Ranaghat. The results of the demonstrations carried out by Babu Ramanath Ray and Munshi Kismat Sheikh of Chuadanga proved to be very successful. Babu Surendra Nath Chatterji of Ranaghat obtained 74 maunds and 25 seers of *gur* per acre from his *samshara* sugarcane manured with *beel silt*. To promote the growth of better agricultural methods in the district the Murshidabad Association allotted Rs. 200 to the Superintendent of Agriculture, Presidency Division, for the supply of

potato seeds, sugarcane cuttings and manures to *bonâ-fide* cultivators. The experiments with potatoes made by some of its members were promising. From the report received from the President, Bogra Association, it appears that the Manager of the Jaipur Government Estate under the supervision of the late President made experiments through 115 tenants of the estate with Darjeeling and Nainital potatoes, and it was found that, according to the nature of the soil in which they were sown and the amount of care taken in their cultivation, the yield of Darjeeling seeds varied from 12 to 45 maunds while that of Nainital from 12 to 30 maunds. The tenants have now begun to prize these seeds, which it may be noted were distributed free. Sugarcane cuttings from Mauritius and Barbadoes varieties were distributed amongst a total of 19 tenants, but the result cannot be known till next year. A good many members of the Rangpur Association tried various improved methods of agriculture on their own land and helped in persuading a large number of cultivators to try them also. Many people have also been persuaded to preserve cowdung in covered pits and take more care in selecting their seeds. To encourage the cultivators to follow improved methods of agriculture, the Rangpur Association awarded prizes to those who obtained the best results by following these methods.

Agricultural Demonstrations conducted by the Department.

17. With regard to the Demonstration work of the department, the following explanatory remarks appear necessary :—

Manures.—The question of manures is important in Bengal not so much from any pressing necessity from the raiyat's point of view as from the possibilities of their economic use. The natural factors favourable to the use of manures are generally (1) security against loss of crop from natural agencies (2) a copious and well-distributed rainfall, (3) suitable climatic condition for the growing of a valuable crop. Added to these is the important economic consideration of capital or its equivalent in credit.

Although the Department has in many ways benefited through the last redistribution of the provinces, in one particular it has suffered severely. The principal crops of Western Bengal have not been subjected to a botanical selection, the main work of the department in this part of the Province having been of an agricultural nature mainly with reference to manures. When the last redistribution was made the Economic Botanist, Dacca, was already fully occupied with the study of the Eastern Bengal crops and has consequently had no time to study those of Western Bengal. The result is that the Agricultural Department is unfortunataly at present engaged in an uphill demonstration of the use of manures in the least promising part of the province, and where improved seed, for the use of which no extra capital is required, would probably have met a ready demand. Under the most favourable circumstances it will unfortunately take many years to bring the crop selection work in Western Bengal up to the high standard obtained by the expert staff at Dacca. As a consequence the district demonstration work in Western Bengal cannot hope to meet with the same success as in Eastern and Northern Bengal, and this circumstance should be kept in mind in comparing the relative progress of the two divisions of the Presidency.

Seeds.—The improvement of the jute and rice crops through plant selection has been referred to above. Demonstration work can only be said to have begun and calls for no comment.

Improved methods of cultivation, etc.—A certain amount of success is recorded in the demonstration of the pitting of cattle manure. Attempts to introduce this practice by demonstrating the results through improved crops will be misleading and are unnecessary.

Selection of seed.—Demonstrations on the selection of jute for seed purposes have been dropped. The real objection to the system is that the more important qualities of individual jute plants, *e.g.*, the percentage of fibre cannot be detected by a casual inspection and require to be estimated by actual weighment.

Introduction of new Crops.—Successful attempts are being made to introduce potatoes into Eastern Bengal as a *rabi* crop for the lower-lying areas. Although one of the minor activities of the department and although the operations are beset with considerable difficulties in the way of securing suitable seed, the idea is sound in conception and deserves support. The same remark applies to the attempt to introduce groundnuts into parts of Western Bengal: neither crop, if extended, would compete with any of the principal existing crops but would fill a definite want in the present rotations.

The full details of the demonstration work conducted in each division during the year under report are given in the roports of the Superintendents of Agriculture which are published separately. The demonstration work in the Chittagong Division was largely affected by floods and in the Burdwan Division by want-of sufficient rainfall.

The main items of the demonstrations were—

(1) *Demonstrations on the value of manures.*—Bone-meal, castor-cake, tank-silt, conserved cowdung and *dhaincha* as green manure were tried in the Burdwan Division, but for the want of adequate rains the crops failed to a considerable extent especially in the districts of Bankura, Birbhum and Midnapore. Nevertheless the good effects of bone-meal and *dhaincha* green manuring on paddy were very apparent. In the Presidency Division, bone-meal, castor-cake, *dhaincha*, Chilli saltpetre and superphosphate proved successful everywhere. The increase in yield of aman paddy due to application of bone-meal was in one case as high as 13½ maunds per acre. In the Rajshahi Division bone-meal was extensively tried but was not successful except in Bogra, Rangpur and the northern parts of Rajshahi. In the district of Malda it is being used to manure mango trees, and in Rajshahi it is used on the mulberry lands and gives fairly good results. Bone-meal demonstrations were conducted in this division in 17 plots of jute, 166 plots of paddy, both aus and aman. Cowpea and *dhaincha* were used as green manure and they proved successful. There were altogether 69 plots of aman paddy manured with *dhaincha* and 96 plots were manured with cowpea. Green manuring with sunhemp was also practised in Pabna, Bogra and Rajshahi districts. There were 16 plots to test the residual value of bonemeal. Of them 13 were slightly successful. In the Dacca Division bone-meal was tried on paddy and jute with much success. An average net profit of Rs. 22-3-3 per acre was obtained in the Dacca district. In Mymensingh the average net profit worked out over Rs. 12 per acre. Over 550 maunds of bonemeal were supplied to the cultivators of this division during the year under report. The effect of bone-meal and lime in the jungle tracts in the Dacca and Mymensingh districts was very marked. Bone-meal has been established as an all-round manure for paddy in the sadar subdivisions of Noakhali and Comilla. It was not very successful in Chittagong.

(2) *Introduction of superior varieties of seeds.*—Potatoes are becoming a popular crop and the demand for seed is increasing. In the Presidency Division the Darjeeling variety was very successful, the outturn being about 180 to 240 maunds per acre. In Rangpur the Darjeeling variety was tested against the local variety in 28 plots and in each case the former proved superior to the latter.

Newly-imported English potatoes acclimatised in Darjeeling were tried in five places in the 24-Parganas district and the outturn obtained from *magnum bonum* variety was about 192 maunds per acree.

Cuttings of superior varieties of sugarcane such as B147, B208, yellow tanna, striped tanna. vendamukhi, gandari and shamshara were distributed in all the divisions. The average yield of *gur* from these varieties in the Rajshahi Division was from 75 to 100 maunds per acre.

Groundnut was introduced in the districts of Birbhum and Bankura. It was grown with success in the Chittagong Division but it did not prove an economic success in the 24-Parganas district.

Over 600 maunds of the Economic Botanist Dacca No. 1 paddy seed and 25 maunds of the Fibre Expert's selected jute seed were distributed to the cultivators of the Dacca Division. There were 40 plots under these seeds in the Rajshahi and Chittagong Divisions. Everywhere the Fibre Expert's jute

seed proved superior to the local varieties and the demand for these seeds is gradually increasing.

Bangalore papaya was tried in Jessore with an estimated profit of about Rs. 600 per acre and its success induced many persons in that locality to grow it.

Jowar, cowpea and carrots were grown for fodder in the Rajshahi and Dacca Divisions and the cultivators are gradually realising the advantage of growing these crops. An expirement on cactus as a famine fodder was carried on at Bankura with good results.

Several sorts of *rabi* crops, English vegetables, fruit-trees, tobacco, etc., were grown in several places in the Province with success.

Seed selection.—The practice of seed selection especially of paddy and jute in the raiyat's fields is steadily gaining favour with the cultivators. In Dacca 189 and 152 cultivators grow paddy and jute respectively from selected seeds. In the Rajshahi Division the selected seeds were tested on 12 plots.

Introduction of improved agricultural implements.—The Meston plough, Planet Junior hand-hoe, Don, Chain pump, Knapsack sprayer, spring tooth harrow, three-rolled crushing mill and shallow iron pan were extensively demonstrated throughout the province with success, and several of these implements were supplied to the public during the year under report.

Agricultural Shows and Fairs.

18. Agricultural shows were held in seven places during the year, as compared with 19 such shows held in the previous year. A statement giving details of those shows will be found in Appendix I. Owing to financial stringency, the departmental contribution was reduced to Rs. 400 including Rs. 100 paid to the Flower Show at Kurseong which was attended by the Deputy Director, although no departmental exhibits were shown. Exhibits from the department were sent to Dacca, Meherpur, Banjetia and Suri shows, the last of which was attended by Mr. Blackwood. The shows were for the most part industrial as well as agricultural, and in some of them such as at Dacca, Suri, etc, cattle were also exhibited.

7.—Publication of Agricultural Information and supply of seeds, manures and implements.

19. The following leaflets, bulletins and reports were published by the department during the year under report :—

(1) Leaflet No. 3 of 1915—Methods of Testing Seeds (in English and Bengali).

(2) Leaflet No. 1 of 1916—Groundnut (in English and Bengali).

(3) Leaflet No. 2 of 1916—The Mango shoot-borer (in English and Bengali).

(4) Bulletin No. 2 of 1915—Potato Cultivation (in Bengali).

(5) Annual Report of the Department of Agriculture, Bengal, for the year ending 30th June 1915.

(6) Annual Reports of the Expert Officers of the Department of Agriculture, Bengal, for the year ending 30th June 1915.

(7) Season and Crop Report of Bengal for the year 1915-16.

(8) " Krishi Samachar" or Year Book of the department in Bengali for the year 1321 B.S.

20. **Supply of seeds, manures and implements.**—It has been already mentioned that with the expansion of demonstration work seed-stores have been established in the five Divisions of the Province, each under the Divisional Superintendent of Agriculture in order to meet larger demands for selected types of seeds, bone-meal and various kinds of chemical manures and improved agricultural implements.

Appendix II contains a statement showing the quantities of seeds, etc. issued from each store in the course of the year.

SECTION II.

Fisheries.

21. **Administration and Tours.**—In the Fishery Department, the four years' agreement of Mr. T. Southwell, Deputy Director of Fisheries, expired on the 5th December 1915. Recommendations were made to Government to make the appointment a permanent one. Orders have been received from the Secretary of State for India after the close of the year confirming Mr. Southwell in his appointment. Messrs. B. Das and S. M. Mohsin continued to work as Superintendents of Fisheries. The services of the Zoological Assistant Babu S. N. Ghosh have been extended for another year, prior to his confirmation in class I of the Subordinate Agricultural Service subject to the condition that he obtains a proficiency certificate in Zoology.

Mr. Southwell was on tour for 116 days during the year visiting and making fishery surveys of almost all the fishing centres in the two provinces (Bengal and Bihar and Orissa). As both the carp and *hilsa* culture stations were opened at Cuttack and Buxar last year, more touring was done in Bihar and Orissa than in Bengal. Work on board the new steam-launch was confined to the Khulna area which was visited several times, particularly during the *hilsa* season. Mr. Southwell attended the Pusa meeting in February last and at the request of the Director of Fisheries, Punjab, he inspected, in December last, the fishery operations that are being conducted by that Government. The two Superintendents of Fisheries, as well as the Zoological Assistant to Mr. Southwell, remained a considerable portion of their time on tour in the two provinces. Mr. Das spent several days at Jogardanga near Garbetta in the district of Midnapore, where he observed the actual spawning of the carp in a *bandh*. Besides attending exhibitions, the Superintendents had to visit Amta and Champadanga very frequently during the last year's rains for procuring carp fry for distribution.

22. **Work done during the year.**—Mr. Southwell's report deals, as in previous years, with his work in both the Provinces of Bengal and Bihar and Orissa. The most important feature of the last year's fishery work was the discovery of the actual spawning of carp in a *bandh* at Jogardanga near Garbetta in the district of Midnapore. From information received that carp regularly breed in this as well as in the neighbouring *bandhs*, Mr. Das, Superintendent of Fisheries, was sent to observe the phenomenon. It has been found that breeding takes place in very shallow water (about one foot) at the very onset of the rains. In Europe, the development of carp eggs occupies several days depending largely on temperature, whereas in Bengal, the eggs hatch out in about 24 hours. This discovery definitely disproves the popular notion that the Indian carp breed in current water only, and never in tanks. In some European countries, however, they are bred in teichs or tanks specially constructed for the purpose. This method has also been successfully adopted in America. Mr. Das, Superintendent of Fisheries, who had been deputed to Europe to study artificial breeding of carp tried the method for several successive seasons, but no definite results were obtained from his experiments. Mr. Southwell was accordingly inclined to believe that Indian carp would not breed in stagnant water and his recent investigations were confined to laboratory work to find out what brings about impotence in the carp when placed in tanks. The new discovery is of the highest importance as the Fishery Department will now be in a position to supply large quantities of pure carp fry to the public. During the current season the department will supply nearly half a million for the stocking of tanks.

As the *hilsa* is, next to the carp, the most important food fish of the people, the Department has devoted much attention to the subject of

the artificial culture of this fish. Last year, *hilsa* hatcheries were established at Cuttack and Buxar, but owing to the scarcity of brood fish at the proper season, the reason of which is not known, another failure in this direction has to be recorded. It must, of course, be admitted that the elucidation of the habits, particularly the breeding habits, of the *hilsa* is by no means a simple matter. Similar work in America has only been accomplished as a result of prolonged and careful observations by a large number of trained men. At any rate our information regarding the habits of the *hilsa* is materially increasing, although it is not likely that we shall be in a position to artificially cultivate this species for some time yet. Some investigation work was carried on with the help of the launch in the rivers of the Khulna district and also at Goalundo, where a large number of *hilsa* was examined with a view to study the development of the reproductive organs of both the sexes of the species. It seems very probable that the *hilsa* breed during their actual passage up the rivers, although it has not yet been possible to fix definitely any of the breeding grounds of the species.

With reference to other species of fish, Mr. Southwell reports that he has worked out in full the life-history and breeding habits of *Notopterus chitala* and certain other allied species, but no attempt has yet been made to study the habits of other important food fishes, such as bhetki, topsi, etc., as these fish breed almost at the same time as the carp and certain *Siluridae*, to which the department has up to the present confined its observation.

With regard to research, Mr. Southwell reports that, owing to pressure of other work, he was unable to devote much time to this branch. He is of opinion that this is particularly unfortunate as the real development of the fisheries of the Province depends almost entirely on scientific research. Thus, although the life-histories of the Indian carp and of *Notopterus chitala* have been fully and accurately worked out and the nature of various fish diseases and fish parasites determined, the description of which will be found in certain publications of the Indian Museum, the series of embryonic forms deposited in the Fishery Laboratory still await description. Mr. Southwell therefore proposes to give more attention to the scientific side of his work than he has hitherto been able to do.

A great deal of useful work was done during the year in the formation of co-operative societies among fishermen. The two Superintendents of Fisheries, as well as the Zoological Assistant, were given a course of training in co-operative principles under the Registrar of the Co-operative Societies and three new societies have been inaugurated during the year. Thus there are at present seven societies, one in each of the districts of Dacca, Khulna, Midnapore, Howrah, Murshidabad, Pabna and Tippera.

During the year under review an important step has been taken by Government with regard to the settlement of Government Fisheries. It has been arranged with the Commissioners of Divisions that six months before the lease of a fishery expires, the Collector of the district in which the fishery is situated should consult the Deputy Director of Fisheries with regard to the Departmental management of the Fisheries and also as to what restrictions are necessary in the regulation of close times and methods of fishing. If departmental management is found undesirable, perference in settlement should be given to a co-operative society of fishermen, and in the absence of such a society, to one or more selected fishermen, and failing that to one or more carefully selected persons who are not fishermen. Mr. Southwell recommends that the practice of settling Government fisheries by open and unrestricted auction should be discontinued, and in every case conditions as to close seasons and methods of fishing should be embodied in the lease in consultation with the Deputy Director. As a result of the above arrangement, the Fishery Department hopes to be able to extend its operations with a view to effect improvements in the Government fisheries in the Province.

Mr. Southwell has reported that the unsettled future of the department and of the Deputy Director in particular during the year seriously interfered with his work as he deemed it inadvisable to incur expenditure on hatcheries and other large experimental work unless he was certain that these could be utilized afterwards. Now that the department has been placed on a permanent footing, these difficulties will disappear.

A perusal of the report will shew the magnitude of the undertakings of this department and the practical method in which Mr. Southwell has set about to accomplish much with a small staff.

23. **Fishery publications.**—The Fishery branch of this Department published the following in the course of the year :—

(1) Bulletin No. 8—Certain Details relating to the Fish Traffic in Bengal, Bihar and Orissa for the year ending 31st March 1915.
(2) Bulletin No. 9—Statistics of Fish imported into Calcutta for the year ending 31st March 1916.
(3) A brochure in Bengali on "The Carpfry Industry in Bengal."
(4) A report dealing with the fishery rights in the estuaries and rivers of Bengal and Bihar and Orissa.
(5) A Bengali translation of a paper on "Some Local Industries Dependent on Aquatic Animals."
(6) "Certain Facts relating to the Fisheries in Bengal and Bihar and Orissa." (Published in the Agricultural Journal of the Department of Agriculture, Bihar and Orissa).
(7) "On Some Indian Cestoda." (Published in the Records of the Indian Museum).
(8) A paper describing a large number of fish diseases. (Published in the Records of the Indian Museum.)
(9) A report on parasites from fish and aquatic birds in the Chilka Lake. (Published in the Records of the Indian Museum.)

SECTION III.

Sericulture.

24. **Administration and Tours.**—In the Sericultural Department, Babu A. C. Ghosh continued to hold the post of the Superintendent of Sericulture with his head-quarters at Malda. Mr. Grangeon, the Silk Expert, is still serving in the French Army and his hybridising experiments are now being continued by Mr. P. C. Chaudhuri at Berhampore. Miss M. L. Cleghorn is also carrying on her cross-breeding experiments in Calcutta. The Superintendent of Sericulture spent 335 days on tour in inspecting the nurseries.

Work done during the year.

25. **General.**—One special and four regular meetings of the Bengal Silk Committee were held during the year. At the special meeting the Hon'ble Mr. N. D. Beatson Bell, C.S.I., C.I.E., and Mr. H. Maxwell-Lefroy, Imperial Silk Specialist, were present.

Mr. Lefroy, who has been appointed to report regarding the revival of the Silk Industry, visited Bengal in December 1915. He proposes to visit this Province again in November next, to review the present situation carefully and make suggestions as to the future policy with regard to Sericulture in Bengal.

The scheme proposed last year is still under the consideration of Government. As described in the last year's report, the main feature of the scheme is to supply disease-free seed to the whole province partly from Government nurseries direct, but mainly through selected professional rearers. Work is being carried on tentatively on these lines on a small scale.

At present 8 Government sericultural nurseries are in work in the Province.

The disinfection of village rearing houses was continued with good results the outturn obtained by the rearers being reported to be in almost every case satisfactory.

Two students passed the final examination of the Sericultural class attached to the Berhampur Central Nursery, and one of them was paid a reward of Rs. 250.

The total receipt from the outturn of the nurseries came to Rs. 16,828-8-4½ against Rs. 13,069-1-9 of the preceding year. The total expenditure including the establishment was Rs. 85,965-6-4.

26. **Rajshahi Sericultural School.**—There were 11 boys at the beginning of the year ; 9 appeared at the final examination and all passed. They will receive their rewards in the next winter for the construction of model rearing houses. Eight passed students of the previous year received the second instalment of their rewards. There were 12 boys on the roll on the 30th June, 5 of whom were Muhammadans and 7 Hindus. The cocoons grown in the school are reported to be gaining in popularity among the rearers. The school possesses 22 bighas of land, of which 16 bighas are under mulberry against 15 bighas in the previous year. The total receipts were Rs. 438-6 against Rs. 389-10 of the previous year. The total expenditure was Rs. 7,498.

27. **Hybridising experiments.**—This work was continued by Mr. Chowdhuri on the lines laid down by M. Grangeon before his departure for France in August 1914. The ultimate object is the creation of cross-bred races which, while retaining the native multivoltin character, will yield cocoons equal to those given by the superior univoltin races reared in Japan, China, France, etc. So far the best result has been obtained by crossing the multivoltin race of Madagascar (male) with the indigenous race called Nistari (female). This cross has been in existence since M. Lafont's time and has reached the 26th generation. It has yielded on an average $2\frac{1}{4}$ grains of silky substance per cocoon against $1\frac{1}{4}$ to $1\frac{1}{2}$ grains yielded by Nistaris. The cocoons of the new cross also contain less floss and so there is less waste of silky matter.

The effects of the change to the hills (Kurseong) have been salutary, each race showing an increase in its yield of silk, percentage of outturn per laying and the average number of eggs laid per laying. It is now intended to find out by actual trial the best time of the year for this change, and also determine whether a race is more benefited by one rearing or by consecutive rearing from May to September.

To secure proper comparison each race is subjected to the same treatment in the process of rearing and fed on the same kind of leaves.

In order to test the constancy of the races and to establish an accurate value of their merits and commercial possibilities it is proposed to rear them on a sufficiently large scale. This will at the same time afford wider scope for selection.

28. **Miss Cleghorn's experiment.**—A grant of Rs. 10,000 was sanctioned by Government during the current financial year for the extension of these experiments and research work. Miss Cleghorn's laboratory has been much enlarged, the three control-rearing houses for village rearers completed and a new mulberry plantation of about 8 bighas of land in Hastings House has been planted with about 400 thin-sweet-leaved male mulberries. A part of the plot is also being prepared for the cultivation of bush mulberry according to indigenous methods. Mr. H. Maxwell-Lefroy, Imperial Silk Specialist, inspected this experiment and expressed much satisfaction with the work which is being done. Miss Cleghorn has given effect to Mr. Lefroy's suggestion that a comparative trial should be made between her hybrid race and the indigenous Nistari and Desi. The work done so far is very promising, and the results will be found in detail in a report published separately.

SECTION IV.

Miscellaneous.

29. **Arboriculture.**—The progress reports of Arboricultural operation for the financial year 1915-16 have been received from all the districts. The expenditure incurred by the District Boards (except Bakarganj and Darjeeling) in connection with the planting of new trees and maintenance of old avenue amounted to Rs. 33,157-13-11 and the receipts obtained by them from sale of fruits, trees, etc., amounted to Rs. 6,211-10-6. The District Boards of Dacca and Jessore have not prepared their decennial working-plan. Except the maintenance of old trees no new planting was done by the District Boards of Rajshahi, Bogra, Jessore and Dacca. The total number of trees planted during the year was 13,590.

The class for the training of Overseers and Sub-Overseers in Arboriculture was held at the Royal Botanic Garden, Sibpur, from 10th August to 9th September 1915. Fifteen officers attended the course.

30. **Weaving operations.**—Mr. N. N. Pillai, the Weaving Master, spent 321 days on tour during the year in visiting almost all the weaving centres in the Province. In every place he visited he not only demonstrated the advantages of the fly-shuttle loom and other improved appliances, but did his best to induce the local weavers to organize co-operative societies among themselves. In the silk districts of Malda and Murshidabad he demonstrated and introduced the improved reeling machine, which he has constructed to facilitate the reeling of fine deniers of silk with uniform and accurate crossing. The local weavers are said to appreciate the improved machine as it has been constrncted without altering the measurements of the frame or of the swifts of the old machine. At the Suri Exhibition he demonstrated his improved method of reeling wild muga tassar cocoons by a reeling machine At the same exhibition he also demonstrated the advantages of the flyshuttle loom over the existing hand-loom of the district.

At Tribeni in the district of Hooghly he arranged for the organization of an "Industrial School" in aid of the "Industrial Home" under the patronage of the Maharajadhiraj Bahadur of Burdwan. The institution is intended to organize, develop and demonstrate cottage industries so as to help poor people who are able and willing to work. It is proposed to organize a weaving school at the outset and to supplement it later on, as funds would permit, with other industries such as silk reeling, mutka spinning, carpentry and wood carving. The Weaving Master reports that the building is under construction, the looms and other equipments are being made ready under his personal supervision and work will be started as soon as possible. In May last, Mr. Pillai visited Darjeeling and inspected the manufacture of "Lepcha Chadar" by the Bhutias. The "Chadar" is generally woven separately in three equal strips. each 8 feet long and 20 to 22 inches broad, and then converted into a single sheet by sewing together the selvages. At the request of the Secretary of the Darjeeling Technical School, he is preparing a new fly-shuttle loom com plete with accessories to enable the weavers to produce a complete sheet. This, when ready, will be established at the Technical School and demonstrated to the local weavers for their benefit. The introduction of the improved apparatus will. it is hoped, not only produce better quality but also enable the manufacturers to place their productions on the market at a cheaper rate.

31. **Rainfall Stations.**—During the year under report three new rainfall stations were opened. There were altogether 230 stations in the province, out of which only 67 are reported to have been inspected.

32. **Jute Forecast.**—This work was carried on on the lines adopted in previous years, the panchâyats' figures being checked by departmental officers. This checking was formerly done by the fieldmen demonstrators of the department with the result that demonstration work suffered considerably at a most important season of the year. To obviate this difficulty a temporary staff has been appointed for jute forecast work.

33. **Wage census.**—As the next quinquennial Wage Census Report is due to Government in 1917, necessary arrangements are being made for the preparation of the report. As a preliminary step, the District Officers have been addressed and printed schedules circulated to them with a view to obtain complete information regarding the prevalent rates of wages of the various working classes throughout the province. Instructions have been issued to take the census in December next and compilation will be taken in hand when the schedules containing the necessary information are received back from the District Officers.

34. **Expenditure.**—Expenditure on miscellaneous experiments and enquiries during the year ending 30th June 1916 other than those carried out in agricultural stations was Rs. 4,63,082-0-6.

35. **Agricultural Implements.**—A list of the agricultural implements and machines reported to have been tested in the Province during the year is given in Appendix III.

36. **Seed rates.**—Appendix IV contains a statement showing the seed rates per acre of the principal crops grown in the province.

APPENDIX I.

Agricultural Shows and Fairs.

Serial No.	NAME OF FAIR AND LOCALITY.	Date on which the exhibition was held.	Amount contributed by the Agricultural Department.	Officers of the Department who attended or helped in the Agricultural Shows.	Exhibits sent and demonstrations given by the Department.
1	2	3	4	5	6
	DACCA DIVISION.		Rs.		
1	Agricultural and Cattle Show amongst Co-operative Societies, Dacca.	23th March 1916	300	Deputy Director of Agriculture, Eastern Bengal, and Dacca Farm staff.	Departmental exhibits.
	RAJSHAHI DIVISION.				
2	Flower and Vegetable Show, Kurseong (Darjeeling).	24th April 1916	100	Deputy Director of Agriculture, Eastern Bengal, attended and judged the exhibits.	.....
3	Agricultural Exhibition, Falakata (Jalpaiguri).	8th February to 8th March 1916.	...	.....	.....
	BURDWAN DIVISION.				
4	Suri Cattle and Produce Show (Birbhum).	29th and 30th January 1916.	...	Director of Agriculture, Deputy Director of Agriculture, Western Bengal, Superintendent of Agriculture, Burdwan Division, District Agricultural Officer, Birbhum, Weaving Master and Veterinary Inspector.	Departmental exhibits, practical demonstration of water-lifting appliances, and magic-lantern lectures.
	PRESIDENCY DIVISION.				
5	Agricultural and Industrial Exhibition, Meherpore (Nadia).	20th February 1916 and the following six days.	...	Deputy Director of Agriculture, Western Bengal, District Agricultural Officer, Mr. S. K Dutt, and Superintendent of Agriculture, Presidency Division.	Departmental exhibits, practical demonstration of chain pump and Meston ploughs.
6	Agricultural and Industrial Exhibition, Bangatia (Murshidabad).	31st January to 2nd February 1916.	...	Deputy Director of Agriculture, Western Bengal, Superintendent of Agriculture, Presidency Division, District Agricultural Officer Mr. S. K. Dutt, Superintendent of Fisheries.	Departmental exhibits, seed implements, practical demonstration and lantern lectures.
7	Keserpahar Agricultural Exhibition, Kandi Subdivision (Murshidabad).	14th to 20th February 1916.	...	.....	.....

APPENDIX II.

Statement showing the quantities of seeds, manures and implements issued from the seed-stores under the department during the year ending 30th June 1916.

Burdwan Division Seed-store.

Seeds ...	...	705 maunds 20 seers 12 chataks (about 26 tons), 77,370 sugarcane cuttings.
Manures	...	1,042 maunds 20 seers (about 38½ tons).
Implements	...	16.

Presidency Division Seed-store.

Seeds ...	...	30 maunds (2,460 lbs.).
Manures	...	605 maunds (about 22½ tons).
Implements	...	19.

Seed-Stores in Dacca Division.

Seeds ...	...	11,480½ maunds (421½ tons)*, 52,836 sugarcane cuttings.
Manures	...	875 maunds 33 seers (about 32½ tons).
Implements	...	6.

* This includes 3,672 maunds of potato seeds.

Rajshahi Division Seed-store, Rajshahi.

Seeds ...	...	730½ maunds (about 27 tons) and 57,000 sugarcane cuttings.
Manures	...	482½ maunds (about 17¾ tons).
Implements	...	62.

Chittagong Division Seed-store, Chittagong.

Seeds ...	...	398¾ maunds (about 14¾ tons).
Manures	...	983½ maunds (about 36 tons).
Implements	...	30.

APPENDIX III.

A list of agricultural implements and machines which have been tested in Bengal during the year ending 30th June 1916 and of those in use which are reported to have met with success.

No.	Designation of implement.	Use.	Special advantage or instruction.	Price.	Where procurable.	Name and designation of reporting officer.	Opinion.	Extent to which used by agriculturists.
1	2	3	4	5	6	7	8	9
				RS. A.				
1	Meston plough	Ploughing	Inverts the soil and cuts it in a slanting manner instead of tearing it as the country plough does.	5 12	Messrs. Burn & Co. and Messrs. Leslie & Co., Calcutta.	Divisional Superintendents of Agriculture, Honorary Secretary, Bankura District Agricultural Association.	Very useful on light soil.	Its use is being steadily extended among the cultivators.
2	Sibpur ,,	Ditto	Makes a deep furrow. Specially advantageous on dry soil.	11 8	Bengal Agricultural Department Seed-stores.	J. N. Bose, Esq., Member, District Agricultural Association, 24-Parganas.	Useful	Used by nearly 30 cultivators.
3	Hindustan ,,	Ditto	Makes wider furrows and inverts the soil.	15 0	Messrs. Burn & Co., Howrah.	C. Mustafi, Esq., Superintendent, Chinsura Farm.	Recommended for the cultivation of jute, sugarcane, potato, tobacco and garden vegetables.	Very small.
4	Bullock-gear, double chain-pump.	Irrigation	A single machine can irrigate a large area. It can raise water from a depth up to 12 feet.	278 0	Ditto	Ditto ...	Very useful in extensive farming.	*Nil.*
5	Chain-pump ...	Ditto	Saves a good deal of manual labour. About 3 times more water can be raised than by indigenous methods during the same time.	6 0	Ditto	Honorary Secretary, Bankura District Agricultural Association.	Useful	Very small.
6	Iron Don ...	Ditto ...	Specially useful when water-level is 3 feet or 4 feet below the land surface.	8 0 to 9 8	Bengal Agricultural Department Seed-stores.	Superintendent of Agriculture, Burdwan Division.	Very popular and useful. Much appreciated by the agriculturists.	Its use is rapidly extending among the agriculturists.
7	Planet Junior hand-hoe.	1. Ploughing 2. Hoeing 3. Making out rows, etc.	Saves labour, portable and handy, suitable for vegetable gardening.	22 0	Messrs. T. E. Thompson & Co. and Messrs. Burn & Co.	Subdivisional Officer, Rampurhat.	Very useful on light garden soil; works very neatly.	Not used by ordinary cultivators. The members of the Agricultural Associations use it for experimental purposes.
8	Winnower ...	Cleaning thrashed grains.	Labour-saving and economical.	120 0	Messrs. Burn & Co., Howrah.	C. Mustafi, Esq., Superintendent Chinsura Farm.	Useful in extensive farming.	*Nil.*
9	Three-roller sugarcane mill.	Extraction of juice from sugarcane.	Only one pressing through this mill is sufficient to extract the entire juice from a sugarcane.	85 0	Ditto ...	Subdivisional Officer, Narail.	Far more effective than ordinary wooden mills.	Now used by almost every cultivator who makes *gur* on a large scale.
10	Circular *gur*-making pan.	Boiling juice into raw sugar (*gur*).	A better quality of *gur* is obtained by using this pan.	25 0	Bengal Agricultural Department Seed-stores.	Subdivisional Officer, Rampurhat, and Mr. B. K. Mitra, of Paulsholala.	Useful and economic.	Ditto.
11	Knapsack sprayer.	For applying Bordeaux mixture, etc., to plants.	Labour saving ...	60 0	Messrs. T. E. Thompson & Co.	Superintendent, Agriculture, Rajshahi Division.	A very effective contrivance for applying insecticides and fungicides.	Used by this department on cultivators' lands and also by the tea planters. One machine registered to have been purchased by Mr. H. C. Das, Manager, Chhuramau Estates.

APPENDIX IV.

Statement showing the seed rates per acre of the principal crops grown in the province.

Name of the crop.	Presidency Division.	Burdwan Division.	Dacca Division.	Rajshahi Division.	Chittagong Division
1	2	3	4	5	6
Aman paddy (Oryza sativa)—					
Transplanted ...	40 lbs.	24 to 32 lbs.	72 to 90 lbs. (a)	60 to 90 lbs.	24 to 60 lbs.
Broadcast ...	60 ,,	18 to 24 ,,	72 to 90 ,, (a)	48 to 120 ,,	54 to 120 ,,
Aus paddy (Oryza sativa)—					
Transplanted ...	40 ,,	...	...	...	...
Broadcast ...	60 ,,	...	60 to 90 lbs. (a)	48 to 120 ,,	60 to 114 lbs.
Boro paddy (Oryza sativa).	50 ,,	...	36 to 70 lbs.	48 to 90 ,,	32 to 60 ,,
Jute (Curchorus capsularis and Curchorus olitorius).	6 ,,	9 lbs	6 to 12 ,,	6 to 9 ,,	7 to 14 ,,
Potato (Solanum tuberosum).	800 ,,	800 to 1,200 lbs.	800 to 1,200 lbs.	720 ,,	400 to 600 ,,
Wheat (Triticum sativum).	80 ,,	40 lbs.	60 to 72 lbs.	120 ,,	...
Sugarcane (Saccharum officinarium).	12,000 cuttings.	12,000 to 16,000 cuttings.	10,000 to 12,000 cuttings.	10,000 cuttings.	5,000 to 6,000 cuttings.
Kalai (Phaseolus radiatus).	50 lbs.	50 lbs.	38 lbs.	60 lbs.	14 to 24 lbs.
Mustard (Brassica juncea).	10 ,,	10 ,,	6 to 12 ,,	6 ,,	5 to 7½ ,,
Gram (Cicer arietinum)	80 ,,	60 ,,	30 to 40 ,,	100 ,,	24 to 40 ,,
Lentil (Ervum lens) ...	50 ,,	40 ,,	24 to 30 ,,	60 ,,	16 to 26 ,,
Til (Sesamum indicum)	20 ,,	20 ,,	12 to 20 ,,	6 ,,	14 to 24 ,,
Moong (Phaseolus mungo).	20 ,,	...	12 to 24 ,,	24 ,,	14 to 24 ,,
Linseed (Linum usitatissimum).	20 ,,	...	6 to 12 ,,	6 ,,	10 to 14 ,,

(a) The rates are reported to be much lower in Mymensingh and Bakarganj.

B. S. Press—22-11-1916—1908J—800—B. N. K.

REVENUE DEPARTMENT.

AGRICULTURE.

CALCUTTA, THE 15TH DECEMBER 1916.

RESOLUTION—No. 10016Agri.

READ—

The Report of the Department of Agriculture, Bengal, for the year ending the 30th June 1916.

Staff.—Mr. J. R. Blackwood, I.C.S., was in charge of the Department until the 9th June 1916, on which date he made over charge to Mr. S. Milligan of the Imperial Agricultural Service. Messrs. F. Smith and K. McLean, Deputy Directors of Agriculture, held charge of the agricultural operations in West Bengal and East Bengal respectively. Mr. Smith was on privilege leave from the 14th August to the 11th October 1915, during which period Mr. McLean performed his work in addition to his own duties. Messrs. R. S. Finlow and H. E. Annett worked as Fibre Expert and Agricultural Chemist, respectively, throughout the year. Mr. G. P. Hector worked as Economic Botanist until the 3rd May 1916, when he went on long leave: during his absence his work has been entrusted to Mr. Finlow. The appointment of a Third Deputy Director of Agriculture has been sanctioned by the Secretary of State, but the post will not be filled up until the war is over. During the year there were five Superintendents of Agriculture and ten District Agricultural Officers as in the previous year: there is need for increasing the number of District Agricultural Officers for the purpose of making a fuller use of the results which have been obtained, but for financial reasons the expansion of the Department is necessarily postponed.

2. **Agricultural Education.**—There is no Agricultural College in the Presidency, but the College at Sabaur in Bihar offers special facilities to students from Bengal. The numbers of such students on the roll of this College on the 30th June 1916 were two in the third-year, six in the second-year and 12 in the first-year class. It is to be regretted that the number of students is so small and that the special opportunities for agricultural study are not more fully appreciated by the landholding and cultivating classes, but as yet there appears to be little or no demand for scientific knowledge of agriculture except as an avenue to Government service. Of the two students who were successful in the Final Diploma Examination in March 1916, one has been appointed temporarily under the Government of Bihar and Orissa as a supernumerary agriculturist, the other is reported to have enlisted. The scheme for giving a course of agricultural training on the Dacca Farm to the sons of zamindars is in abeyance for want of any assurance that students will be forthcoming.

3. **Research and Experiment at Agricultural stations.**—The reports of the scientific officers have been published in a separate volume, and the Director has given in his report a lucid explanation of the objects in view and of the results obtained. The Governor in Council has from time to time observed signs of a not unnatural impatience for definite results of research, and he would specially commend this portion of the report to those who feel such impatience: it shows not only that attention is being concentrated on a limited number of objects which are of the highest importance in Bengal, but also that a very decided advance has been made towards substantial improvement of staple crops. Mr. Hector, the Economic Botanist, after testing very numerous varieties of paddy from different places in Bengal has succeeded in isolating and multiplying several excellent types of the transplanted *aman* variety, one of which, viz., *indrasail*, has been selected and tested with very satisfactory results against the best obtainable local varieties in several districts. These results have apparently convinced those who have studied them, for there has been a large demand

for this variety in the immediate vicinity of the Dacca Farm, and arrangements have been made for the further distributions of this seed from other farms. Though it is unlikely that the same variety will be found the most suitable in the totally different conditions of West Bengal, it has been found that *indrasail* has given positive results both at Rajshahi and Rangpur. *Aus* and deep water paddy are also being studied by Mr. Hector, but the experiments are not yet in such an advanced stage as in the case of *aman*. Manurial experiments conducted with bone-meal and lime on the Dacca red soil have shown that whereas a combination of the two gives the best results in the case of jute and *rabi* crops, bone-meal without lime is most effective for rice. The study of the *ufra* disease of rice was continued during the year under report, and a survey of *ufra*-infected districts was undertaken. Further knowledge has been obtained about the habits of the minute worm called *Tylenchus Angustus* which is now recognised as the sole cause of *ufra*, but the work accomplished has not yet reached a stage at which it can be claimed that the ravages of the disease have been in any way checked in the fields. The Imperial Mycologist has arrived at the conclusion that the burning of the rice stubble after harvest, if done thoroughly and on a large scale, will save the subsequent crop, and the Governor in Council approves of the decision of the Director to spread this information as widely as possible : he relies on the Collectors of the districts in which *ufra* disease prevails to co-operate with the Director in disseminating this information, and to impress on the people concerned that the burning which is now generally practised must be thorough, so that the survival of the worm through incomplete burning may be prevented. The Governor in Council desires again to impress on the Director of Agriculture the necessity of keeping a close watch on the progress of this disease, the spread of which should be regarded as one of the greatest calamities that can befall this province. He also attaches much importance to the experiments which are being made with a view to selecting an early ripening variety of deep water paddy which may avoid the worst attack of the disease. Selection and cross-breeding experiments are being continued with regard to jute, and it has been established that Mr. Finlow's pure line selection Kakya Bombai No. 7 is a heavier yielder than any of the local varieties. Experiments are being made with a view to defining the localities suitable for this variety and the demand for the seed is steadily increasing. Though the manurial experiments with regard to jute have not yet yielded a satisfactory solution of the problem, there are indications that the scientific treatment of this subject will lead to valuable results. Among the most important experiments of the past year are those connected with water hyacinth, a weed which is the cause of very serious obstruction to the waterways of Bengal : the experiments indicate that in the potash contained in the ash and in the rotted plant an excellent manure for jute has been discovered, and that the value of the plant for manure may perhaps induce cultivators to clear the waterways which are infested with it. Mr. Annett continued his experiments on cane sugar ; there is a considerable demand for the selected varieties in the neighbourhood of all agricultural stations. His investigation into the process of *gur* making from palm sugar has established the important fact that the wastage of the juice drawn in the day time on account of its inferior quality can be completely eliminated by liming the pots as is done in Madras ; this process results in the perfect preservation of the day juice and in a marked increase in the quality of the night juice. Demonstrations have been undertaken to make this result widely known.

4. **Demonstration and Distribution.**—Now that certain definite results have been obtained by experiment with improved seed and manure, the problems of demonstration and distribution have assumed a greater importance. In the previous year the number of trained demonstrators employed was 83, but as the preparation and checking of the jute forecast occupied their time during a large portion of the busy agricultural season, their demonstration duties suffered. It was therefore decided during the year under review to separate the staff employed for the jute forecast from the demonstration staff : the number of demonstrators was reduced from 83 to 62, and a separate temporary staff of 103 men was entertained for the period of the jute

forecast ; the work of demonstration is thus no longer interrupted during the period from April to September. The principal items of demonstration undertaken by the Department were the value of manures, the introduction of superior varieties of seed and the use of improved agricultural implements. Useful demonstrations were also undertaken by members of the several agricultural associations and very great assistance in demostrating the value of Mr. Finlow's jute seed was rendered by jute firms. The departmental seed stores established in the previous year in the five divisions of the Presidency have increased their output, and measures have been taken for improving this means of distribution, but, as Mr. Milligan has remarked, a more extensive organization is required for distribution of selected jute and rice seed on a large scale. The Governor in Council notices with much interest the initiation of a system of utilizing Co-operative Credit Societies and Panchayats as agencies for the distribution and reproduction of seed, and there is reason to expect good results therefrom.

5. **Cattle.**—During the year under review Mr. Blackwood published his report on his survey of the cattle of Bengal : the report was based on a very thorough examination of the cattle found in the Presidency and of their treatment by their owners, and Mr. Blackwood's main conclusion was that, owing to the climate of Bengal and the general disinclination or inability to provide sufficient food to a superior animal, the best prospect of improving the breed of cattle lay in selection from the best cattle found in the Presidency. His policy at the Rangpur Dairy Farm was based on this conclusion. The Governor in Council has, however, been advised that no very substantial improvement in breed can be expected without importing superior cattle, and it is a fact that the cattle of Bengal are continually replenished from Bihar, and that there exists some demand for better cattle than are now bred in Bengal. It has therefore been decided to retain the best of the indigenous animals which have been collected at the farm, and at the same time to start a separate herd of imported cattle. Though it has always been recognized that cattle breeding was the sole object of the farm, the subsidiary object of showing that mixed farming can be conducted at a profit has been found to have a tendency towards the neglect of fodder crops to the advantage of paying crops such as sugarcane, and it has therefore been decided that no crops other than fodder crops shall be grown on the farm until it is self-supporting in this respect. An unfortunate outbreak of rinderpest resulted in serious losses in the Rangpur herd.

6. **Sericulture.**—M. Grangeon, the French Sericultural Expert, being absent on military duty in France, his experiments were continued by Mr. P. C. Chaudhuri, Superintendent of the Berhampore Central Nursery. The ultimate object of these experiments is the creation of cross-bred races which, while retaining the multivoltin character, will yield cocoons equal to those given by the superior univoltin races reared in France, China and Japan. It has been found that the type obtained by crossing the multivoltin Madagascar male with the indigenous Nistari female, gives the best results. This type is now in the sixteenth generation, and so far they have been found to breed true. It remains to be seen whether they will revert to their dominant parental types afterwards. They yield on an average $2\frac{1}{4}$ grains of silky substance per cocoon, against $1\frac{1}{4}$ to $1\frac{1}{2}$ grains yielded by the Nistaris. There is also less waste of silky matter in the cross types. The experiments of Miss Cleghorn are reported to be full of promise. To enable her to extend her experiments and research work, she has been given a grant of Rs. 15,000 for the current financial year. Her laboratory has been extended, three control-rearing houses have been established, and a new mulberry plantation begun. The hybrid race evolved by her has been found to be superior to the indigenous Nistari and Desi. The Sericultural School at Rajshahi had eleven students on the roll at the beginning of the year. It is satisfactory to find that most of the passed students are constructing model rearing houses, and have started rearing on scientific lines. The Governor in Council is awaiting with much interest the recommendations of Mr. H. M. Lefroy, the Imperial Silk Specialist. Until they are received, no change in the organisation of the Sericultural Department will be made, but the work which is now being done towards the prevention of disease and the discovery of races

which will give an increased yield, and have the power of resisting disease is on the right lines, though it is questionable whether it is conducted on a sufficient scale to achieve commercial results.

7. **Fisheries.**—The preliminary period of the appointment of Mr. T. Southwell, Deputy Director of Fisheries, expired on the 5th December 1915, and it has been decided by the Secretary of State that the post of Fisheries Expert shall be permanent. An important event in the year under review was the discovery that the Indian carp breeds in certain tanks as well as in running water. The importance of this fact lies in the possibilities that it affords for the cultivation in specially constructed tanks of pure carp fry unmixed with the fry of predatory fish. There is a progressive demand for the carp-fry supplied by the Fisheries Department, and the orders received in 1916 for 4½ lakhs of fry are largely in excess of those of previous years: this line of work is likely to result in a substantial improvement in the supply of fish. The subject of artificial culture of *hilsa* continued to receive attention, and though no material success has been attained in this direction, further information regarding the habits of the fish has been acquired: the Governor in Council recognizes that pending the discovery of the places where *hilsa* breed, no large improvement in the supply is probable, and that it is necessary to await results with patience. Three new co-operative societies of fishermen have been established during the year under report, making the total number seven. With a view to afford the Fisheries Department facilities for research work and for the establishment of co-operative societies, orders have been issued that when the lease of a Government fishery is about to expire, the Collector of the district shall consult the Deputy Director of Fisheries as to the desirability of departmental management, and, where this is not practicable as to the best alternative arrangement and as to the restrictions which are necessary in the regulation of close times and methods of fishing. It is hoped that under these arrangements the Government fisheries will be improved and will afford a valuable field for research, and an example to private owners of fisheries. The Governor in Council has much pleasure in acknowledging the valuable work which is being done by Mr. Southwell, and he entertains no doubt as to the benefits which will result from it.

8. Mr. Blackwood relinquished the charge of the Agricultural Department after holding the post of Director for a period of four years. This period was in a great measure one of organization and expansion and of selection of lines of work which were likely to prove beneficial. The Governor in Council desires to place on record his appreciation of Mr. Blackwood's work and to congratulate him on the attainment of certain definite results on the eve of his departure. The lines of development are now well defined in most branches of the work of the Department, and the Governor in Council looks forward with confidence to a period of concentrated work on special lines in which the expert knowledge of the present Director is likely to be of the greatest value. Apart from the specific results which have been noticed in this review, the feature of the year's work which the Governor in Council regards with most satisfaction is the evidence which it affords of the co-ordination of the work of the Agricultural Department with that of other departments and of the public. The assistance of the co-operative department in measures for the distribution and reproduction of seed and in ameliorating the conditions of fishermen has been noticed already. The work of the jute firms in connection with Mr. Finlow's jute and of the agricultural associations in carrying out demonstrations affords a prospect of great utility. But besides these there are numerous passages in the reports of the Director and of the expert officers which indicate a more general interest and a more widespread desire to assist in the work of the Agricultural Department, and it is only by the further diffusion of such interest that the results of scientific investigation can be made beneficial to the cultivators of the soil.

By order of the Governor in Council,

L. BIRLEY,
Secretary to the Government of Bengal.

B. S. Press—16-12-1916—5136C—960—C. A. P.

No. 10017Agri.

COPY forwarded to the Director of Agriculture, Bengal, for information.

No. 10018Agri.

COPY forwarded to the Registrar, Co-operative Societies, Bengal, for information, with reference to paragraphs 4 and 7 of the Resolution.

By order of the Governor in Council,

M. A. MOMEN,
Under-Secy. to the Govt. of Bengal.

CALCUTTA,
The 20th December 1916.

B. S. Press—23-12-1916—5136C—840—C. A. P.

ANNUAL REPORT

OF THE

AGRICULTURAL DEPARTMENT,

BENGAL,

FOR THE

YEAR ENDING 30TH JUNE 1917.

CALCUTTA :

BENGAL SECRETARIAT BOOK DEPOT

1917.

Published by the Bengal Secretariat Book Depôt,
Writers' Buildings, Calcutta.

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DEPARTMENT OF AGRICULTURE, BENGAL.

No. 10243 A.

FROM S. MILLIGAN, ESQ., M.A., B.SC.,
Offg. Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

Dated Calcutta, the 7th December 1917.

SIR,

I HAVE the honour to submit the Annual Report of this Department for the year ending 30th June 1917.

The reports of the expert officers have been published separately as in previous years.

I have the honour to be,
SIR,
Your most obedient servant,
S. MILLIGAN,
Offg. Director of Agriculture, Bengal.

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APPENDIX.

A list of agricultural implements and machines tested in Bengal during the year ending 30th June 1917 and reported to have met with success . i

ANNUAL REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

FOR THE

YEAR ENDING 30TH JUNE 1917.

Administration.

The following branches are under the administrative control of the Director of Agriculture :—

I.—Veterinary Department.
II.—Agricultural Department.
III.—Sericulture and Weaving.

The report of the Veterinary Department has been submitted separately. The Fishery Branch has, during the course of the year, been separated from the Department of Agriculture and now issues its own reports. The present report therefore deals with Agriculture and Sericulture and Weaving only.

SECTION I.

Agriculture.

2. **Administration and Tours.**—I continued in charge of the Department throughout the year. Mr. F. Smith, Deputy Director of Agriculture, Western Circle, held charge of the agricultural operations in the Presidency and Burdwan Divisions. Mr. Kenneth McLean, Deputy Director of Agriculture, Eastern Circle, left on military duty on 5th October 1916. Since his departure the Eastern Circle has been directly under my supervision. The Expert staff at Dacca has been further depleted by the deputation of Mr. Annett, Agricultural Chemist, to the United Provinces, on special duty. Mr. Hector being still on leave the whole weight of the three scientific sections at Dacca has been thrown on the shoulders of Mr. Finlow.

There have been no changes in the personnel of the Provincial Service. There are five Superintendents of Agriculture, one for each Commissioner's Division. In addition the Rangpur Dairy Farm is managed by an officer holding the rank of Superintendent of Agriculture.

District Agricultural officers have now been appointed to the following districts, viz., Dacca, Mymensingh, Faridpur, Bakarganj, Tippera, Noakhali, Pabna, Malda, Rangpur, Bogra, 24-Parganas, Bankura, Birbhum and Midnapore.

3. I spent 110 days on tour visiting nineteen districts. Mr. Smith, Deputy Director, Western Circle, spent 165 days on tour and Mr. Finlow 88 days. Before leaving Mr. McLean spent 40 and Mr. Annett 27 days on tour. The greater part of the time of the Superintendents of Agriculture, the District Agricultural Officers and the Entomological and Mycological Collectors was occupied in touring.

4. With three-fifths of the Expert staff away during the greater part of the year, no work of an original nature could be undertaken. Satisfactory progress towards the elucidation of some of the problems facing the Department has, however, been made and some of the work on hand has been brought to a definite conclusion. In dealing with the year's work of the Department I propose to follow, for the sake of convenience, the sequel adopted in last year's report to which a reference can be made.

1.—Agricultural Education.

5. The original Bengal Agricultural College at Sabour has been under the control of the Department of Agriculture, Bihar and Orissa, since the latest rearrangement of Provincial boundaries. The change has made no difference in the management of the college, which continues to draw its students from the same area as before.

The Principal reports that on 30th June there were 17 students from Bengal, 4 in the 1st year, 8 in the 2nd year and 5 in the 3rd year of the course. Of the two students who sat for the Diploma Examination in March last, one passed and has been employed by the Agricultural Department, Bihar and Orissa. Most of the scholarships awarded by District Boards and private donors continue to be held by Bengal students. The Maling Grant scholarship open to students from the St. Andrew's Colonial Homes, Kalimpong, remained vacant, there being no student from Kalimpong.

The Education Department has been consulted regarding the progress of nature study in primary schools and the agricultural classes in secondary schools. The results have been disappointing and the unsatisfactory progress is attributed to the want of a properly trained teaching staff.

2.—Research and Experiment.

6. The main lines along which the activities of the Department are directed were fully described in last year's report. Details of the past years' work are to be found in the reports of the officers of the Department (published separately).

7. **Rice.**—The study of the Bengal transplanted aman paddy varieties and the Eastern Bengal "aus" varieties has been continued. Part of Mr. Hector's scientific investigations on the rice crop has been published as a Pusa Memoir.

On the economic side, several high yielding varieties of transplanted paddy, previously isolated, have been multiplied for trial on a field scale. It is satisfactory to note that the results of the work of previous years have been confirmed. When it is considered that over two thousand different varieties have been examined, the successful classification of these according to economic qualities, such as yield, is a remarkable testimony to the technique employed by the Botanical Section at Dacca.

Aus paddy.—The pure line "Kataktara," which has hitherto proved the best yielder at Dacca, has been multiplied on a field scale and sufficient seed is now available for preliminary trials in some of the recognised aus tracts in Western Bengal. This will probably be too late a variety for the double cropping system in vogue in Eastern Bengal, but, as the Eastern Bengal varieties are now under examination, the selection of a variety suitable for this tract will only be a question of time.

Deep-water aman pady.—No work has been hitherto possible on this important group of paddies, nor will it be possible to commence work until the Botanical staff has been considerably strengthened.

Disease of rice.—The *ufra* disease of deep-water paddy continues to receive detailed attention both by the local department and by the Expert staff at Pusa.

The report of the Imperial Mycologist on the subject is full of interest and throws considerable light on several hitherto unexplained facts. Boro paddy, for example, although by no means immune to *ufra*, is practically free from it under natural conditions, owing, as Dr. Butler explains, to the prevailing

atmospheric conditions. Meantime the main facts remain the same, viz., that the disease is carried over from one season to another in the rice stubble more especially in the lower and wetter parts of the field. It is thus obvious that a complete destruction of the rice stubble after harvest would prove a cure for the disease, and that the more completely stubble burning is carried out the less *ufra* in following year, other things being equal.

The question may however be approached from another point of view. It seems clear that the *ufra* attack may be directly attributed to the system of agriculture practised in the bhils, which consists in the growing of a deep-water paddy crop every year. The want of a rotation lays the crop open to all sorts of disease, and the wonder is that disease is not more prevalent than it is. From the evidence in our possession it seems certain that the parasite could be almost exterminated within a given area by the substitution for one year of an early ripening crop such as jute or aus paddy. Although re-infection would in time doubtless set in the repetition of this practice at the necessary intervals would probably solve the problem. Some evidence in favour of this view is supplied in the non-occurrence of the disease in a badly infected bhil in the Tippera district after a high flood which completely destroyed the long-stemmed aman paddy in 1915. A similar effect could, without loss of crop, be reproduced by the growing of an aus (or early) crop in an infected area instead of the usual "aman" crop. The aus crop would escape owing to its early maturity and after its removal no food would be left to carry over the parasite. The growing of jute or any other suitable crop would be similar in effect. It is clear, however, that whatever measures are taken either in stubble burning or in the temporary substitution of a different crop for the deep-water paddy, these must be carried out jointly by every one concerned within a certain area, as field boundaries cease to exist once the water has risen in the bhils.

To sum up, the prevention of *ufra*, though by no means easy owing to the necessity of co-operation amongst large numbers of small cultivators, is quite feasible from an agricultural point of view. Success in dealing with the problem will depend largerly on the provision of an adequate staff in the districts concerned. In the meantime, the most the Agricultural Department can do is to offer advice and help to those who are prepared to take joint measures against the disease.

8. **Jute.**—*Varieties.*—The work on plant selection has been continued. The immediate object of this work is the selection of high yielding strains of Capsularis and Olitorius jute for the localities where these two crops are at present grown. During the year several promising new varieties have been selected and are being multiplied. Meanwhile trials at a number of different centeres on land lent by several well-known jute firms have confirmed Mr. Finlow's opinion that Kakya Bombai variety is a heavier yielder than the varieties commonly grown by the raiyats. The demand for seed of this variety has, as a consequence, increased considerably in the vicinity of these centres which have acted as demonstration areas, and the time has come to make a better use of the limited amount of seed at our disposal by a more methodical and exhaustive form of demonstration. The matter is dealt with below under the heading "Seed Distribution." The departmental seed continues to be grown in Bihar and Assam. This arrangement has hitherto proved both convenient and economical as there is little chance of admixture and the seed can be grown better and at less cost than in Bengal.

Other investigations regarding jute.—Last year's results as to the value of applications of potash to jute on the red laterite soil have been amply confirmed, the only point remaining to be cleared up being that of quantity. The year under report has been an unfavourable one for jute on the Dacca laterite, but the best agricultural seasons are by no means the most valuable from an experimental point of view. During the year much valuable information has been obtained regarding the incidence of disease and the varying behaviour of different races of jute under adverse conditions. Perhaps the most interesting part of Mr. Finlow's report is the paragraph dealing with the Rhizoctonia fungus and the effect of potash salts as a preventive of this disease. His results receive strong corroboration from

the fact that this fungus, though commonly found on jute in the laterite tracts which contain practically no potash, is rarely met with in the lower alluvium silts where the soil is richer in that constituent. This line of work is of great interest from the general point of view of the incidence of disease due to malnutrition.

The connection between Mr. Finlow's work on potash and that on "water hyacinth" is now apparent. The laterite soils have been depleted of their potash, possibly through leaching. The water hyacinth which grows luxuriantly on the alluvium soils is full of potash. It can thus be utilized as a means of returning to the laterite part of its lost potash.

9. **Other Crops.**—There is nothing to report regarding investigations on crops other than jute and rice. Work on sugarcane and tobacco has been continued on the lines of previous years. The work on date palm sugar has had to be suspended owing to the absence of the Agricultural Chemist.

10. **Manures.**—Work on this important subject has of recent years suffered from the effects of the latest rearrangement of Provincial boundaries, which not only seriously interfered with the work at Dacca through changes in the staff, but cut off Western Bengal from its Research Station at Sabour. Failure to realize the changed conditions has led to a lack of co-ordination and the neglect of scientific work in Western Bengal. Much valuable information has, however, been obtained at Dacca by experiment. The soil survey mentioned in the report of the Agricultural Chemist is a necessary step towards an application of the results on an extended scale.

11. **Experimental stations.**—No new agricultural stations were opened during the year. The want of district seed farms and testing stations is now beginning to be felt. The lack of such stations causes undue delay in coming to a decision regarding the merits of new varieties of crops and the application of the results obtained at central stations to local conditions. The problem of maintaining a supply of pure seed for distribution has now become a pressing one. Administrative sanction for three new district farms of 20 acres each has recently been accorded by Government. These farms will form the headquarters of the District Agricultural Officer, will contain the district seed store, and will form the nucleus of a district seed supply. It is hoped that when funds become available that the Agricultural Department will be represented in every district by a headquarters of this type.

Owing to the absence of so large a proportion of the Expert staff, experimental work on the existing farms has been curtailed. This has, however, provided a much needed opportunity for the laying out of new experimental areas and the retesting of some of the existing plot series as regards fertility. This work has been further facilitated in the farms of the Eastern Circle by the final selection of one variety each of transplanted paddy and jute for distribution in the districts. As a result, there will be at all the experimental farms a sufficient reserve of standardized plots for new work.

12. **Cattle-breeding.**—The policy of the Rangpur Cattle Farm has been altered with the object of obtaining definite information within a reasonable time as to the respective merits of crossing with stock imported from other parts of India and grading up indigenous cattle of a definite type. Fundemental work of this kind is necessary before a decision is arrived at on any fixed policy regarding cattle-breeding.

13. **District work.**—*Seed distribution.*—The Department has now arrived, after some years of careful survey of a large number of different varieties of jute and aman paddy, including all those commonly grown in Eastern and Northern Bengal, as to the best yielding types for these tracts. The thoroughness of the survey may be judged from the fact that over 2,000 different varieties of paddy and 500 of jute have been subjected to examination. One variety of transplanted paddy and one of jute have accordingly been multiplied for distribution in the districts. The quantity of seed in the hands of the Department will, however, always be comparatively small and the problem arises as to how to make it available to the enormous number of growers of these crops in the area referred to.

Reasons were given in last year's annual report why distribution of seed should be extensive rather than intensive and why it should be conducted on methodical lines. It was further suggested that the agency of the

panchayets might be made use of for this purpose. A trial was accordingly made in the Dacca and Mymensingh districts of the distribution of 100 maunds ($3\frac{2}{3}$ tons) of jute seed in $\frac{1}{4}$-pound packets and 2,000 maunds (73 tons) of paddy in 10-pound bags. Each packet of jute contained enough to produce seed for one acre in the following year, and each bag of paddy enough for about 25 acres. The bags were distributed to the panchayets from the thanas. The growers were asked to keep the resulting crop for seed in the succeeding year if they were pleased with it. The distribution was carried out without much difficulty and disclosed an easy and effective manner of demonstrating the new varieties with a comparatively small quantity of seed over a large area, and at the same time establishing an adequate seed supply in the districts. The Department hope to have 6,000 maunds (220 tons) of paddy and 1,500 (55 tons) of jute seed available for distribution next year, and it is proposed to distribute the whole amount on the above system. By this means it is hoped that in a few years' time all the growers of Capsularis jute and transplanted paddy in Eastern and Northern Bengal will have the opportunity of seeing and testing Indrasail paddy and Kakya Bombai jute.

14. **Distribution of Sugarcane setts, seed potatoes, etc.**—The distribution of sugarcane setts from the agricultural stations and of Darjeeling seed potatoes has been continued along the lines of previous years. The difficulties of railway carriage and loss of weight on transit have necessitated the establishment of local centres for the distribution of seed potatoes. This system is under trial in the Dacca Division and it is hoped that the supply will be shortly taken up by local dealers and that the work of the Department will be confined to demonstrations. There is a large extent of low-lying land in Bengal which might be more profitably utilized in the rabi season than it is at present, and potatoes are one of the few suitable crops which can be suggested for this purpose. The movement is, therefore, quite sound as applied to such lands. For higher lands, however, the crop cannot be recommended without irrigation.

The question of the distribution of the new varieties of sugarcane from a larger number of centres is under consideration, and it has been decided that the principle observed in the distribution of paddy and jute seed, viz., extensive rather than intensive, must be adhered to in order to make the relatively small quantity of available setts as effective as possible.

15. **Ground-nuts.**—The area under this crop has considerably increased in the Birbhum district owing to the interest displayed by the Collector in the matter. There are reasons, however, against too rapid an advance. The crop is a valuable one both from a revenue and scientific points of view, but it is subject to disease of a virulent type. Although up to date the crop in Bengal has been free from disease, there is no guarantee that it will long continue so. It is, moreover, better that such difficulties should be met and overcome before the area becomes too large. It seems also probable that phosphatic manuring will be necessary in the laterite areas where the crop has been already introduced. The establishment of an agricultural station at Birbhum or Bankura will be necessary to solve such difficulties.

16. **Demonstrations on the use of Manures.**—The demonstration work on the use of bonemeal and castorcake has been continued. For reasons stated above, the former has been more successful in the red laterite tracts and the use of this manure is making some headway in the Western districts Castorcake has been found an economical manure for sugarcane, potatoes, etc., in the alluvial tracts, and considerable quantities are now used in some districts.

The use of *dhaincha* as a green manure for paddy is also a subject of demonstration. The two chief obstacles in the way of the extension of this form of manuring are :—

(1) the supply of *dhaincha* seed the price of which tends to rise on account of the increased demand, and

(2) the uncertainty of the early monsoon rainfall.

17. **Entomology and Mycology.**—The report of the Imperial Mycologist on the *ufra* disease of rice has been already referred to. The thanks of

the Department are due to him for his invaluable assistance in investigating this disease and suggesting remedial measures.

SECTION II.

Sericulture.

18. **Administration and Tours.**—During the year Babu A. C. Ghose held the post of Superintendent of Sericulture with his headquarters at Malda. The Superintendent of Sericulture spent 297 days on tour. In the absence of Mr. Grangeon, Mr. P. C. Chaudhuri, Superintendent of the Berhampore Central Nursery, held charge of the hybridizing experiments in addition to his own duties. Miss. M. L. Cleghorn continued her scientific work on silk worms at her residence at Alipur.

A report on the silk industry in India by Mr. H. M. Lefroy is still under consideration of the Government of India. The operations of the Department in Bengal accordingly have been continued on the lines of previous years. These are :—

(1) The distribution of disease free seed cocoons to silkworm rearers.

(2) The improvement of the existing silkworm races by cross-breeding.

The former operations are supervised by the Superintendent of Sericulture, Bengal, under the control of the Director of Agriculture assisted by the Bengal Silk Committee as an advisory body, while the improvement of silkworm races in the direction of higher outturn and improved quality of produce is being carried out by the Department at Behampore and Miss Cleghorn at Alipur. The expenses of Miss Cleghorn's work are being borne by the Bengal Government.

At present each of the silk-producing tracts possesses one or more seed-producing central nurseries. There are seven such nurseries in addition to a nursery at Bogra specially established for the production of Chhotapolu seed.

The total expenditure on the nurseries for the year amounted to Rs. 91,361 as compared with Rs. 85,965 for last year, an increase of Rs. 5,396. Against this, however, the receipts have risen from Rs. 16,828 to Rs. 28,737, an increase of Rs. 11,909.

19. **Cross-breeding Experiments.**—The work commenced at Berhampore by M. Grangeon has been continued on the lines laid down by him, under the supervision of Mr. P. C. Chaudhuri at the Berhampore Nursery. The aims of this work have been fully described in former reports and may be briefly stated as being the production of the high yielding multivoltine varieties of silkworms. A trial of one of the most promising of the hybrid races was conducted this year by Mr. deMinvielle, a member of the Bengal Silk Committee. This race showed great vitality and produced cocoons giving a high silk outturn. At the same time indications were not wanting that the multivoltine character is not yet fixed, and that further work is required in this direction. The results, however, are sufficiently promising to warrant extensive trials of these races on a commercial scale at one of the nurseries. Arrangements are being made to utilize the Berhampore Central Nursery for this and similar work.

20. **Scientific.**—Miss Cleghorn has continued her scientific work on silkworms at Alipur. A bulletin on pebrine disease of silkworms by Mr. C. M. Hutchinson, Imperial Agricultural Bacteriologist, published by the Imperial Department of Agriculture, has thrown considerable light on the incidence of this disease. The work is of the utmost importance to the Bengal industry, indicating as it does the necessity of a revision of Pasteur's methods as applied to multivoltine races. Mr. Hutchinson describes a new and more accurate method for the detection of pebrine in the silkworm moth. Arrangements have been made to give this method a trial in one of the existing nurseries.

SECTION III.

Miscellaneous.

21. **Arboriculture.**—Progress reports of arboricultural work for the financial year 1916-17 have been received from all districts. The expenditure incurred by the District Boards (with the exception of Bakarganj and Darjeeling) in tree planting and maintenance of old avenues amounted to Rs. 33,289-15-9. Receipts from the sale of fruits, trees, etc., amounted to Rs. 7,487. The total number of trees planted during the year was 9,880.

The class for the training of overseers and other subordinates of District Boards in arboriculture was held at the Royal Botanic Garden, Sibpur, from the 15th August to 14th September 1916 and was attended by nine officers.

The revision of the Bengal Manual of Arboriculture (1907) has been completed. The new edition is expected to be published in course of the present year.

22. **Weaving.**—Mr. N. N. Pillai, Weaving Master, spent 323 days on tour, in the course of which he visited almost all the reeling and weaving centres in the Presidencey and gave practical instructions in improved methods and assisted in the formation of co-operative societies.

The chief need of the weavers lies in an improvement of their financial condition. Co-operation in purchase and marketing appears to be the first essential, and until this has been effected there seems little chance of the general adoption of improved methods. Mr. Pillai has shown much keenness in his work throughout the year and has been greatly assisted by the Co-operative Department.

23. **Statistical.**—The two jute forecasts were compiled on the lines of previous years. The quinquennial wages report and the quinquennial crop-cutting experiments report have been issued during the year.

24. **Rainfall Station.**—During the year under report no new rainfall stations were opened, nor was any closed. There were altogether 230 stations in the province out of which only 56 are reported to have been inspected.

25. **Agricultural implements.**—A list of the agricultural implements and machines reported to have been tested in the Province during the year is given in the Appendix.

26. **Expenditure.**—Expenditure on miscellaneous experiments and enquiries other than those carried out in agricultural stations and for sericultural work during the financial year 1916-17 amounted to Rs. 3,32,029 as detailed below :—

	Rs.
Superintendence	73,509
Expert staff	1,96,924
Agricultural experiments	39,546
Seed stores	15,538
Cattle fairs and shows	2,512
Special crops	4,000
Total ...	3,32,029

Acknowledgments.

27. The Department continues to be deeply indebted to a very large number of Government officials and to sympathisers amongst the general public for help in bringing the results of their work to the notice of the raiyats. Where there is work to be done there has been no lack of willing helpers. The presidents of panchayets in the Dacca district, for example, offered their services in seed distribution. The demonstration work in the Rangpur district has been greatly extended through non-official assistance. The whole of the demonstration work in Western Bengal has been done with the assistance of private individuals. The assistance of the Calcutta jute firms through their mufassal agencies has been invaluable to Mr. Finlow in

his work. The bulk of the jute seed for distribution has been grown by Messrs. Birkmyre Bros. in their Assam estates. These instances are merely given to show the extent to which the Department is indebted to the outside public.

Acknowledgments are also due to the administrative staff in all the districts for the keen interest shown in the work of the Department. I am specially indebted to Mr. S. G. Hart, Collector of Dacca, and Mr. J. N. Gupta of Rangpur for much valuable advice on matters concerning the district organization of our Department.

Staff.

28. The staff in general has worked well. The absence of several of the experts through various reasons has thrown a great amount of extra work on the shoulders of the remainder. Although the Agricultural Department is no exception in this respect, it is not too much to say that but for the untiring efforts of a few of the members much of the work on hand would have had to remain in abeyance. Especially would I recommend the work of Mr. Finlow, Fibre Expert, who, in addition to controlling the work of three specialised sections, rendered invaluable assistance to me in the management of the Dacca Experimental Farm. Mr. Finlow highly commends the work of the Scientific Assistants at Dacca and his praise is, I know, well merited.

The work of Babu Rajeswar Das Gupta, Superintendent of Agriculture, Dacca Division, deserves special mention. This officer has shown great capacity in his work generally and his recent appointment to officiate as Deputy Director of Agriculture, Eastern Circle, is a matter of much satisfaction to me. I have also to acknowledge the excellent work of Mr. D. N. Mookerji, my Personal Assistant. Mr. Mookerji is due to retire this year and his services will be much missed in the Department in which he has served for a number of years both as Assistant Director and, latterly, as Personal Assistant to the Director.

APPENDIX.

A list of agricultural implements and machines which have been tested in Bengal during the year ending 30th June 1917 and of those in use which are reported to have me with success.

No.	Designation of implement.	Use.	Special advantage or instruction.	Price.	Where procurable.	Name and designation of reporting officer.	Opinion.	Extent to which used by agriculturists.
1	2	3	4	5	6	7	8	9
				Rs. A.				
1	Punjab plough	Ploughing ...	Ploughs to a depth of about 9" and completely inverts the soil. Can be drawn by two strong country bullocks.	35 0	Messrs. Octavius Steel & Co., Calcutta.	S. P. Sen Gupta, Esq., District Agricultural Officer, Dacca.	Works satisfactorily.	Two ploughs have been sold in the year under report.
2	Soil inverting light iron plough.	Do. ...	Ploughs to a depth of about 6" and completely inverts the soil. The plough is light and can be easily worked by two ordinary country bullocks.	11 0	Departmental Seed Stores.	Ditto ...	Ditto ...	Likely to gain favour with the cultivators. Two ploughs have been sold in the year under report.
3	Planet Junior hand-hoe.	Weeding and interculture of crops in rows.	Saves manual labour, portable and handy; also suitable for vegetable gardening.	22 0	Departmental Seed Stores. Messrs. W. Leslie & Co., Calcutta.	D. N. Mitra, Esq., District Agricultural Officer, Faridpur, and S. N. Sen, Esq. District Agricultural Officer, Barisal.	Very useful on light garden soil. Works very neatly.	Used to a very limited extent owing to high price.
4	Three-roller sugarcane mill.	Extraction of sugarcane juice.	Extracts greater quantity of juice than in ordinary wooden mills.	60 0 to 70 0	Messrs. Burn & Co.	B. K. Mitra, Esq., Member, District Agricultural Association, Hooghly.	Good	Used by agriculturists to a large extent.
5	Platt Mackarcoy's cotton ginning machine.	Cotton ginning ...	By far a superior contrivance for ginning cotton than any in ordinary use in this country.	200 0	Imported from England.	Ditto ...	Do.	Nil.
6	Suri hoe ...	Tilling and weeding.	Suitable for loosening the soil in time of flowering of ground nut.	2 0	J. C. Roy, officiating District Agricultural Officer, Birbhum.	J. N. Sarkar, Esq., Superintendent of Agriculture, Burdwan Division.	Very nicely works in the rows of crops.	Introduced by officers of this department this year only.
	Planet Junior wheel hoe.	Used as a marker for sowing seeds in a line, for making burrows, for hoeing both sides of the line and for weeding, etc.	One man can do ten times as much work as is done by other country-made implement.	15 0	Superintendent of Agriculture, Chittagong Division.	Babu Ambica Charan De of Gupta Anka, district Noakhali.	Very useful ...	Nil.
8	Meston plough	Ploughing ...	It turns the soil leaving no ridges as in the ordinary country plough.	6 8	Messrs. Burn & Co	R. C. Das, Esq., Manager, Churaman Estate.	A very useful implement and the price being moderate is within the means of the ordinary cultivators.	The implement has been introduced among a number of cultivators in the Churaman estate through the exertion of the District Agricultural Officer, Malda. In one case, a cultivator has replaced all his country ploughs by Meston ploughs.

B. S. Press—18-12-1917—2319J—750—R. F.

GOVERNMENT OF BENGAL.

REVENUE DEPARTMENT.

Agriculture Branch.

CALCUTTA, THE 20TH DECEMBER 1917.

RESOLUTION—No. 8872Agri.

READ—

The Report of the Department of Agriculture, Bengal, for the year ending the 30th June 1917.

MR. S. MILLIGAN of the Imperial Agricultural Service was in charge of the Department throughout the year, and Mr. F. Smith, Deputy Director of Agriculture, Western Circle, was in charge of operations in the Presidency and Burdwan Divisions. In Eastern Bengal the Department has been short-handed: Mr. Hector, Economic Botanist, was absent, on leave, throughout the year: Mr. McLean, Deputy Director of Agriculture, joined the Indian Army Reserve of Officers on the 5th October 1916, and Mr. Annett, Agricultural Chemist, was deputed to the United Provinces on special duty connected with the war on the 28th September 1916. The Director of Agriculture took charge of Mr. McLean's work, and Mr. Finlow, Fibre Export, supervised the departments of the Economic Botanist and Agricultural Chemist. In consequence of this depletion of the expert staff no original work could be undertaken, and Mr. Annett's important work on date-palm sugar was unavoidably suspended. Nevertheless, the report is able to indicate the many-sided activities of the Department. There has been satisfactory progress in utilizing the results of previous investigation and in the continuance of experimental work on the lines of the past. As in the previous year there was a Superintendent of Agriculture in each of the five divisions, and there were ten District Agricultural Officers, the additional officers mentioned by the Director having been appointed after the close of the year.

2. One of the most interesting features of the year's work was the distribution in the Dacca and Mymensingh districts of small quantities of *Kakya Bombai* jute seed and *Indrasail* paddy seed through panchayats to cultivators. This represents the culmination of a careful survey over many years during which the qualities of over 2,000 varieties of paddy and 500 varieties of jute have been tested with reference to their yield and hardihood. The heavy yields of the above named two varieties and the growing demand for seed were mentioned in the report of 1915-16: this demand has been fully maintained and arrangements are being made for distribution on a larger scale in the coming year in the districts of Eastern and Northern Bengal. Other important work affecting the Eastern districts is the discovery of the manurial value of "water hyacinth", a weed which has become a source of serious obstruction to navigation, and has been found to contain a large proportion of potash. Mr. Finlow's investigations have already resulted in the sale of about 750 tons of hyacinth ash representing the destruction of about 75,000 tons of the green plant. There is a growing demand in Eastern Bengal for sugarcane setts from the agricultural farms and for Darjeeling seed potatoes, and the problems of distribution are receiving attention.

3. In Western Bengal the Department is not yet in a position to recommend agricultural improvements on the same scale as in those portions of the Province to which the experimental work of the Dacca Farm is immediately applicable. There has been a marked increase in the area under groundnuts in the Birbhum district; but Mr. Milligan advocates caution in

the extension of this crop owing to its liability to virulent disease, the methods of overcoming which have not yet been tested. The "Kataktara" variety of autumn rice has been proved to be a high yielder at the Dacca Farm, and sufficient seed is now available for preliminary trials in Western Bengal where it is expected to be suitable. The use of bonemeal manure is reported to be making some headway in the western districts.

4. Further knowledge has been obtained on the subject of *ufra*, the disease which causes serious ravages in the deep-water winter rice crop of several districts in the Dacca and Chittagong Divisions. It has been known for some time that this disease is due to a parasite called *Tylenchus Angustus* which is able to remain alive in the rice stubble during the interval between harvest and sowing: it has also been known that autumn rice, transplanted winter rice and *boro* rice, which is usually transplanted in December and January, are comparatively free from the disease. It has now been established that all kinds of rice are equally capable of developing the disease under favourable conditions, but that deep-water winter rice is particularly susceptible for two reasons: there is often a very short interval between the drying of the stubble of the old crop and the sowing of the new crop and the parasite is thus able to survive this interval, and the crop begins to mature at a season when the atmosphere is at its dampest, when the plants are particularly susceptible to the attacks of the parasite. The advice which has previously been given to burn the rice stubble completely as soon as possible after the harvest still holds good, and as Mr. Milligan has observed, complete destruction of the stubble after harvest would probably prove a cure for the disease; but the fact that on the lowest ground the stubble does not become dry enough for burning until very shortly before sowing time renders it very difficult to give full effect to this advice, and as the rising water carries infection from one field to another, a field on which the stubble has been carefully burnt may suffer in the following year. The alternative to complete destruction of the stubble is the substitution of a different crop the stubble of which will not remain on the ground until sowing time. The reply to such advice would generally be that no crop but deep-water winter rice can be grown on the land because the water rises so high: in 1913 Dr. Bulter expressed his doubts as to the validity of this argument, and he remarked that in certain areas in the Noakhali district transplanted winter rice had been substituted for the broadcast variety as a result of the extension of jute cultivation, inasmuch as jute can be followed by a crop of transplanted rice, but not by a crop of broadcasted rice. Dr. Butler also remarked on the fact that transplanting is much more troublesome than sowing broadcast, and he mentioned this as an explanation of the contention that it was impossible. His views receive confirmation from the facts reported by the Collector of Dacca regarding one of the worst *ufra*-infected tracts in his district in which transplanted *boro* rice has recently been substituted on a considerable scale for winter rice sown broadcast. Similarly, in the flood affected portions of Noakhali district cultivators were induced to grow *boro* rice in 1916. In this connection much interest attaches to the report of the Divisional Superintendent of Dacca that transplanted rice has been introduced as a novelty with good results in Faridpur district. During the year under review Mr. Shaw, the Imperial Mycologist, has continued the investigation of this important subject of *ufra*, and the Mycological Collector at Dacca has been principally employed in connection with it: an Assistant Mycological Collector was employed for six months in surveying *ufra*-infected tracts in Faridpur and in a portion of Bakarganj district and large areas were found to be infected. The Collectors of Dacca and Tippera in consultation with the officers of the Department conducted experiments in early ploughing and stubble burning in their districts: the results were inconclusive owing to the liability to infection by flowing water of the area dealt with in Dacca, while the freedon from *ufra* of the area dealt with in Tippera may have been due to other causes as the disease was much less prevalent than usual in the neighbourhood. These experiments, however, have not been without their value in concentrating attention on the disease, and the Governor in Council desires to acknowledge the assistance which Mr. Hart, the Collector

of Dacca, has given to the Agricultural Department in this connection. This subject has been reviewed at length because the Governor in Council desires once more to impress on his officers the importance of combating the disease : he trusts that all District and Subdivisional Officers in the areas affected, who have not already done so, will make themselves acquainted with the literature on the subject, and will endeavour, in consultation with the officers of the Agricultural Department, to encourage remedial measures. He considers that the importance of dealing effectively with a virulent disease to which the most important crop of the Presidency is liable is greater than that of introducing new crops and improved agricultural methods.

5. At the close of the year the stock at the Rangpur Cattle Farm included 73 cows, 2 bulls, 65 bullocks and 49 calves and young stock. The worst of the cows are gradually being weeded out and replaced by animals conforming to a definite type, but only 19 of the cows came up to the qualifying yield for admission to the herd of 1,000 lbs. of milk per annum. No advance was made during the year in carrying out the new policy of developing two distinct herds, indigenous and cross-bred, in order to facilitate a decision whether the cattle of the Presidency can best be improved by direct importation from elsewhere or by breeding in the Presidency with selected local bulls or with imported bulls.

6. The Sericultural branch of the Department continned to work on the same lines as in previous years. Babu A. C. Ghose, Superintendent of Sericulture, was in charge of the operations for the production of disease-free seed cocoons at central nurseries for sale to rearers, the supervision of the production of seed cocoons by selected professional rearers, the disinfection and structural improvement of village rearing houses, and the improvement of mulberry plantations. There was a marked advance in the price obtained for silk during the year, and the departmental receipts from the sale of seed cocoons increased from Rs. 16,828 to Rs. 28,737. The expenditure on the nurseries amounted to Rs. 91,361 which does not include interest on the outlay on buildings. Mr. Hutchinson, the Imperial Agricultural Bacteriologist, has published an important bulletin on pebrine disease from which it appears that the existing methods for detecting pebrine in the silkworm moth are of doubtful efficacy : arrangements have been made to try the new and more accurate method described by him. On the experimental side Mr. P. C. Chaudhuri continued at the Berhampore nursery the work initiated by M. Grangeon : one of his hybrid races was tried by a member of the Silk Committee : the outturn of silk was satisfactory, but the multivoltine character of the race does not appear to be absolutely fixed. Miss Cleghorn continued to rear on a larger scale the hybrid Italian-Japanese and *Nistari* race started in 1911 : there is no doubt as to the vitality of this race under the hygienic conditions in which Miss Cleghorn rears it, and it now remains to test it at one of the nurseries under conditions more nearly approximating to those which village rearers can provide.

7. Mr. Pillai, the Weaving Master, visited all the principal weaving centres in Bengal and was in close touch with the Co-operative Department without whose assistance the prospects of Bengal weavers would be gloomy.

8. The Governor in Council has much pleasure in acknowledging the valuable services of Mr. Milligan as Director of Agriculture : he has shown marked administrative ability in the organization of schemes of seed distribution, and his expert knowledge of agriculture has been of great help in dealing with the numerous problems which confront the Department. He desires also to record his appreciation of the good work done by Mr. Finlow, whose duties have been very onerous owing to the absence of so many members of the staff : his patient work on jute at the Dacca Farm has been rewarded by the appreciation of the growing number of people who have profited by the use of *Kakya Bombai* jute seed. Babu Rajeswar Das Gupta, whose services are highly spoken of by the Director, has been promoted since the close of the year to officiate for Mr. McLean as Deputy Director of Agriculture. The jute firms in Eastern Bengal have continued to co-operate with Mr. Finlow in the testing of jute seed, and the supervision which they have given to the cultivation of comparative plots has made it possible to

rely on the accuracy of the results obtained: their assistance has not only advertised a particular kind of jute seed but has helped to make the Agricultural Department better known among cultivators. No less valuable have been the services rendered by Presidents of Panchayats in the Dacca district and by non-official workers in Rangpur and in the districts of Western Bengal. On all sides there are signs of an increased interest in the work of the Department, and there are demands for assistance which the existing staff has much difficulty in meeting.

By order of the Governor in Council,

L. BIRLEY,

Secretary to the Govt. of Bengal.

No. 8873Agri.

Copy forwarded to the Department of Agriculture, Bengal, for information.

By order of the Governor in Council,

M. A. MOMEN,

Under-Secretary to the Govt. of Bengal.

Calcutta,

The 20th December 1917.

B. S. Press—21-12-1917—2503J—814—C. W. M.

REPORT

OF THE

AGRICULTURAL DEPARTMENT,

BENGAL,

FOR THE YEAR

1917-18.

CALCUTTA :

BENGAL SECRETARIAT BOOK DEPOT.

1918.

Published at the Bengal Secretariat Book Depot,
Writers' Buildings, Calcutta.

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DEPARTMENT OF AGRICULTURE, BENGAL.

No. 657 C.

FROM S. MILLIGAN, ESQ., M.A., B.SC.,
Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

Dated Camp Calcutta, the 18th June 1918.

SIR,

I HAVE the honour to submit the Annual Report of this Department for the year 1917-18.

The reports of the expert officers have been published separately.

I have the honour to be,
SIR,
Your most obedient servant,
S. MILLIGAN,
Director of Agriculture, Bengal.

[Maximum limit, 18 pages.]

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REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

FOR

1917-18.

Introductory.

THE last report submitted was for the year ending 30th June 1917. In view of the fact that this date happens to be in the middle of the *kharif* season, and with the object of securing the coincidence of the period covered by the report with that of one of the agricultural seasons, the date has been changed to the 31st of March. This date, which is at the end of the *rabi* season in Bengal, also coincides with the close of the financial year. The present report thus relates to the period of nine months from the 1st July 1917 to the 31st March 1918. The report deals with the operations of the Department in the Agricultural and the Sericultural and Weaving branches.

The report of the Veterinary Department is issued separately.

SECTION I.

Agriculture.

2. **Administration.**—I remained in charge of the Department throughout the period under report. Mr. Smith continued as Deputy Director of Agriculture, Western Circle, in charge of the agricultural operations in Western Bengal. The vacancy in the Eastern Circle caused by the deputation of Mr. McLean to military duty was filled by the appointment of Babu Rajeswar Das Gupta to officiate as Deputy Director. Mr. Finlow, Fibre Expert to Government, supervised the Chemical and Botanical sections in the absence of Mr. Annett and Mr. Hector. The latter, however, returned from leave in October. Mr. McLean still remains on military duty and Mr. Annett's services have been retained by the Government of India for a further period.

The vacancy in the Provincial Service caused by the appointment of Babu Rajeswar Das Gupta as officiating Deputy Director of Agriculture, Eastern Circle, was filled by Babu Jamini Kumar Biswas.

The addition of three District Agricultural Officers to the district staff, fell within the period under review. Five more posts have been sanctioned bringing up the total number of these posts to 17.

My Personal Assistant Mr. D. N. Mukerji, M.R.A.C., retired on pension in November and was succeeded by Maulvi Wali-ul-Islam of the Provincial Executive Service.

3. **Tours.**—I spent 110 days on tour during the nine months, in the course of which I visited 16 districts. During the same period Mr. Smith was on tour for 123 days, and during five months Babu Rajeswar Das Gupta

spent 141 days on tour. Mr. Finlow spent 124 and Mr. Hector 27 days (during five months) in the districts. The Superintendents of Agriculture and the District Agricultural Officers were continually on tour.

1.—Agricultural Education.

4. The Principal of the Agricultural College at Sabour reports that during the session 1917 the students from Bengal numbered 17. Three out of five who appeared in the Diploma examination were successful, and five out of seven appearing for examination under the new two years' course were granted certificates of proficiency. Three scholarships, awarded by the District Boards of Jessore, Mymensingh and Pabna, were held by Bengal students. The Grant Scholarship again remained vacant as no student from the St. Andrew's Colonial Homes, Kalimpong, joined the College.

As a result of enquiries from the Education Department it would appear that although some little progress has been made in nature study in primary schools, the movement remains hopelessly handicapped through the general incompetency of the teachers to undertake the teaching of this subject. Being a strong believer in nature study as a school subject amongst the agricultural community, I would for that very reason deprecate attempts being made to push the movement until teachers can be found capable of presenting the subject in an interesting and attractive light.

The question of the introduction of agricultural subjects into middle schools is, under the orders of Government, receiving the attention of the Department.

2.—Research and Experiment.

5. **Fibres.**—The Annual Report of this section is full of interest.

Jute.—The Dacca Agricultural Station had a bad year agriculturally, and especially so for jute, but like most bad seasons, it was a very valuable one from an experimental point of view. The crop was sown six weeks late; but, although small outturns were harvested, comparative results were clearly demonstrated, and, as a result of the unfavourable season, some new phenomena of great interest were observed.

Jute varieties.—(*a*) *Corchorous Capsularis.*—The work of this crop has proceeded on the lines of previous years, viz., the examination of promising new varieties, the establishing of new lines from the Kakya Bombai variety, and the arrangement for seed supplies of the latter which is being distributed in the districts. As mentioned in Mr. Finlow's report, a large amount of *chlorosis* made its appearance amongst the *capsularis* varieties at Dacca. The single plant cultures behaved in a singular manner with regard to this disease, nearly all containing *chlorotic* and *non-chlorotic* plants in varying proportions, only two pure lines showing complete immunity. The *olitorius* varieties, on the other hand, were singularly free from the disease. An examination of the rooting systems of diseased and healthy plants showed that, in general, *chlorotic* plants were deeper rooted than *non-chlorotic.* Mr. Finlow is inclined to think that the disease may thus be more or less confined to the red soils which have poisonous subsoil strata, but a great deal of it was noticed by myself at Rangpur this year in the young crop on the silt lands of that district. There is, therefore, a possibility that this disease may yet become formidable in some districts. If, however, hereditary immunity may be obtained by cultivating shallow-rooted varieties, the cure is probably already in our hands. Whether any danger is to be apprehended or not from this disease, the necessity of maintaining a comprehensive collection of varieties at headquarters, as has been done, and the value of such a collection, is apparent.

(*b*) *Corchorus Olitorius.*—Yield tests of six of the best pure lines of *corchorus olitorius* were conducted at the Rajshahi and Chinsura Farms. The Chinsura plots were spoiled by excess of water, but at Rajshahi all the varieties yielded well, R. 26, and two others better than the remainder. As

the former variety is considered rather more desirable all round, it has been selected for outside trials. Comparative outturn trials with the three best varieties will, however, be continued. R. 26, which yielded 29 maunds of fibre per acre, is a very fine type of the *desi* jute, and the seed should meet a ready demand. Mr. Finlow has thus now produced one type each of *capsularis* and *olitorius* jute for distribution in the districts. His section still arranges for the supply of pure seed for distribution, and produced 1,200 maunds of seed of Kakya Bombai and 12 maunds of R. 26 for this season. Arrangements are being made for a similar amount of the seed of Kakya Bombai and 200 maunds of the *olitorius* variety R. 26 for next year.

Manures for jute on the red soils.—Experimental work on this subject was confined to confirming the previous years' results regarding dressings of potash for jute. Although the crop, as explained above, was a poor one owing to late sowing, the differences in yield due to the application of potash, whether in the shape of Water Hyacinth ash or as potash salts, was just as marked as in previous years. Moreover, the use of this manure as an antidote to "Rhizoctonia" has been very effective as was stated in last year's report. The figures given by Mr. Finlow this year show that the number of diseased plants was reduced by 90 per cent. by the use of potash salts applied in the form of Hyacinth ash in a field where jute had been grown successively for two years. The manurial programme for the current year consists of quantitative experiments with Water Hyacinth, after the completion of which we will be in a better position to advise regarding *optimum* dressings of the ash and rotted plant

Mr. Finlow gives some remarkable figures regarding the effect of lime and bone on the yield of *aus* paddy in a plot series on the Dacca Farm, where the average increase in paddy amounts to 10 maunds per acre, the net return for Rs. 40 worth of manure amounting to Rs. 110. The results are interesting, showing how it is possible to grade up the red soil of Dacca to a fair degree of fertility. But the returns do not indicate that a profit has been made, or that a profit would be made by taking up a plot of equally bad land and manuring it in the manner described. As the land is really under a process of reclamation, the correct interpretation from an agriculturist's point of view is that, with an expenditure of Rs. 40 per acre on manures spread over two years, the land has been raised to a fair level of productiveness. Profit can only be obtained after the land has been brought up to the economic level of production. No raiyat could have made a living on the unmanured plots of this series. The results, however, show that the conversion of the acid red soil tract into fair agricultural land is quite possible through the application of lime and bonemeal in moderate quantities.

Trials of Kakya Bombai jute by firms at their mufassal agencies were repeated as a check on last year's results, the plots in this year's experiments being reversed. The check was thus a very complete one. All classes of land were included, the yields varying from 8 to 34 maunds per acre in the case of the Dacca variety and from about 7 to 27 maunds in the case of the local varieties, the all-over average being 2 maunds in favour of the former. This, taken with last year's average increase of 3 maunds per acre gives an average for the two years (with the experimental error further reduced by the "reversing" of the plots) of 2½ maunds of fibre in favour of Kakya Bombai jute over local jutes. As Mr. Finlow's original claim was that his selection was about 1½ maunds per acre on an average better than the average of local varieties, the results show that his estimates have been well within the mark. Mr. Finlow mentions another point which is of interest to those who have followed the history of the development of late varieties of jute. He has contended all along that if yield is to be the main object in selection work on this crop, the late flowering (not necessarily the slow-growing) races will alone give maximum yields owing to the natural branching of the plant at the time of flowering. For some years a controversy raged around this point, it being contended that, in districts where paddy was grown immediately after jute, the latter, if late flowering, would not be ready to cut at transplanting time. The fact of the matter is that jute cut before flowering is of better quality than when cut later, and that, within limits, the crop can be cut practically at any time. The people let their jute

stand until it has flowered and branched in order to get a maximum outturn. A late flowering variety has thus two advantages :—

(1) That it has a much greater range of harvesting period.

(2) That, other things being equal, it will continue to build up stem instead of spending its substance in branches.

The worst class of jute from the point of yield and quality is obviously the early flowering variety, and the substitution of a later flowering race in Northern Bengal for some of the early races would undoubtedly be of great economic importance.

In addition to the seed utilized for sale and distribution in Bengal, a further amount of 100 maunds of Kakya Bombai seed has been supplied to the Agricultural Department in Bihar, where a demand for this variety has sprung up on account of its high yielding qualities.

Sunn-hemp.—Mr. Finlow's work on the improvement of sunn-hemp fibre, as mentioned in his report, is of great importance to agriculture in India generally. Owing to the present shortage of flax, jute has recently been largely used in the manufacture of canvas. But jute cannot hope to permanently replace a hard wearing fibre like flax in canvas making. Sunn-hemp fibre, on the other hand, although possessing excellent wearing properties, is too rough for spinning in its ordinary commercial form. Mr. Finlow, however, has succeeded in elaborating a process for the softening of this fibre so as to render it fit for spinning. If the process is capable of development into an industrial scale, there will be an immediate, and probably permanent, market for sunn-hemp for new purposes. An improvement in the quality of sunn-hemp would, needless to say, be of the greatest economic importance to India.

Sida.—This crop has been under investigation for some years and a satisfactory line has been derived from a plant found by Dr. Butler in Burma some years ago. The results of the trials at Dacca, however, seem to indicate that "Sida" is not likely to prove a satisfactory substitute for jute in Bengal from the point of the grower. Mr. Finlow is inclined to think that it may be found satisfactory in the Central Provinces and has accordingly forwarded seed for trial there.

6. **Botanical Section.—Rice.**—*Transplanted varieties.*—The work on these varieties was continued on the lines previously laid down. Several new varieties have been selected which promise to be almost the equal of Indrasail (Dacca No. 1) in yield. One of these, a comparatively fine variety, should prove a valuable selection from the point of view of the *bhadralogh*. Meanwhile, Indrasail holds the field in Eastern Bengal and has in addition given excellent results in Bihar, so much so that the Agricultural Department of that province has been supplied with 500 maunds of seed for distribution this year. Further afield, the Director of Agriculture, Central Provinces, testifies to its high yield at the Raipur Farm. Work in Western Bengal has not progressed so far, but a survey of the varieties of the Burdwan and Presidency Divisions has been started and a large collection of these will be grown at the Chinsura Agricultural Station this season. Comparative trials of Indrasail and the Chinsura selected Nagra paddy must be considered inclusive owing to the contradictory results obtained by a large scale experiment conducted by the Farm and a 62-duplication 100-plant test by the Botanical staff.

Aus paddy.—Tests of the Eastern Bengal *aus* varieties have been continued. The *kataktara* variety is now out on district trials in both Eastern and Western Bengal, and results will be obtained in the ensuing season. This variety has been selected out of several pure lines giving nearly equal outturns. The remaining varieties in the Dacca collection are nowhere in comparison.

I am glad to be able to report that, owing to the addition of another Assistant to the Botanical staff, it has been possible to make a start on the examination of the long-stemmed deep-water varieties, for which a special tank has been excavated on the Dacca Farm. This work will be complicated and difficult, but the area under this class of paddy in Eastern Bengal is enormous and the crop demands special attention on that account.

A specially constructed terraced area has been added to the Farm for the sake of facilitating investigation regarding the water requirements of different varieties.

Crossing.—The work on crossing has been continued and additional information regarding the inheritance of useful characters has been recorded.

Experimental technique.—Transplanted paddy offers a great field for the employment of a system of multiplication of very small areas as an accurate means of varietal tests. The matter has received a considerable amount of attention by the Botanical section. Mr. Hector, after an examination of several years' figures, concludes that differences in yield down to 10 per cent. can be determined by growing the varieties within the same *kiari* in 25 alternate plots of 100 plants each. Needless to say, data of this kind are of the utmost importance in the examination of a large number of varieties.

7. **Chemical Section.**—The principal work of this section has been—

(*a*) The continuation of the provincial soil survey from a chemical point of view.

(*b*) Analytical and selective work on sugarcane varieties.

Considerable progress has been made with the provincial soil survey. Fifty soil samples representing the silt and red soil tracts of Eastern and Western Bengal have been analysed. As was to have been expected, the silts of both Eastern and Western Bengal show a general similarity with regard to mineral content, although here and there local divergencies have appeared. They are, generally speaking, rich in potash and well supplied with phosphoric acid. Lime salts are fairly plentiful in Eastern Bengal, but in general no free carbonate is found. In Western Bengal the supply of lime appears to vary considerably from place to place. On the whole, therefore, the silts of both Eastern and Western Bengal appear to be well supplied with mineral plant food, and there is no immediate fear of exhaustion of the more important constituents.

The older alluvium as represented by the red soils is, as will be seen from an examination of the typical analytical figures given by Mr. Finlow, much poorer in phosphoric acid, potash, and lime. This information is not altogether new, as occasional soil analyses have been already made, but the present work represents the first systematic attempt to compare the composition of typical soils of the province.

Alongside the soil analyses, an examination of the ash of typical crops is being carried out, as it has been found from experience that the former are sometimes apt to be misleading without further information. It is hoped that a combination of the two different sets of the analyses will help to throw more light on the subject than can be obtained by a soil analysis alone.

Sugarcane.—An examination of the Bengal varieties has led to the elimination of 41 out of 51, and the selection of 10 for further trial. The selection has been based on sugar content and suitability to local conditions. Owing to the varying conditions in the province as regards soil, rainfall and drainage, it is unlikely that any one variety will suit all districts, and careful local corroboration of the Dacca results will be necessary.

Exotics.—On the whole, the best exotic canes at present in our possession appear to be the *Tannas* and *Java 247*. The latter, however, is a more recent importation, and our experience hitherto has been that exotics are rather inclined to deteriorate. A notable exception, however, has been *Yellow Tanna*. On the whole, the best of the imported canes are better than the best local varieties, although some of latter such as the *Gandari Samsara* and *Vendamukhi* are distinctly good.

Date sugar.—For the reasons explained in last year's report, the investigation with regard to date-palm sugar has been suspended. The work, however, had reached a stage at which a resumption would be easy.

8. **Entomology.**—The item of chief interest in the report of this section is the discovery of the egg of the mango weevil and the time of laying. This has for long baffled entomologists, probably because it has been all along supposed that the egg is laid when the tree is in flower. It has now been discovered that the weevil lays its egg when the fruit has attained half its

natural size, the eggs being laid singly in small depressions on the surface of the fruit, and covered over by a coating of a black substance giving the appearance of black spots. This discovery, combined with evidence that the egg-laying period is confined to a week or two at the utmost, ought to render remedial measures, if not easy, at least practicable. As a very considerable amount of damage is done to mango fruit by the weevil, the subject is of great importance. Mention is also made in the report of the attack on the jute crop at the Dacca Farm by "hairy" caterpillars. Considerable information has been obtained regarding the migratory habits of these insects and the comparative value of various remedial measures. To ensure success, the pest must be attacked when first seen as eggs, at which stage they can be easily removed in large numbers. Moreover, the cultivators are usually employed at this time in weeding the crop, and should be able to remove most of the eggs which are easily detected on the leaves.

9. **Mycology.**—*Ufra disease of rice.*—Observations with regard to this disease are still conducted by the Mycological section (under the advice and assistance of the Imperial Mycologist). Field operations have been handed over to the district staff of the Department. Experiments at Dacca, designed to ascertain whether the disease is communicated through seed from an infected area, have at last shown that this is possible. The Mycological Collector supervised the selection of sugarcane cuttings from the point of view of fungus disease. The rest of the work of the section consisted of the collection and examination of fungi.

10. **Agricultural stations.**—The work at these stations is apt to be eclipsed by the reports of the expert officers. It must, however, be remembered that, strictly speaking, much of the work of the latter has been done in collaboration with the Agricultural Section of the Department. For example, the yield tests of the *olitorius* varieties of jute have been carried out by the Rajshahi and Chinsura Farms. Again, the field work connected with the sugarcane investigation, which has been taken in hand by the Chemical section, is largely conducted outside Dacca on the Farms at Chinsura, Rajshahi and Rangpur. The manurial experiments on lime, bonemeal and potash all belong to the Dacca Farm, although the interpretation of the results has rightly been left to the Chemical section. Such collaboration due to the excellent understanding between the Heads of Sections as also between their Assistants, is highly commendable and leads to a great increase in efficiency. But on that very account the reports of the experimental stations hardly do justice to the excellent work going on at many of them. The Dacca Farm report, for example, would tend to leave in the mind of the outsider the idea that this is a particularly uninteresting station. On the contrary, the work in progress is full of interest, more so in fact than that of many of the better known stations in India.

During the year under report, a considerable amount has been done on the agricultural stations to improve their efficiency, and also to render possible a greater variety of experimental work. As pointed out in last year's review, much of the experimental work of these stations as regards crop varieties and manures has been brought to a close; and before starting off on new lines advantage is being taken of this opportunity of recasting some of the old experimental blocks, of taking in more land into the experimental area, and of standardizing experimental plots. All the experimental stations have taken up this work. The results of comparative plot fertility tests, which it is proposed to publish separately after two years' work, are interesting, and confirm the experience of the writer at Pusa, this year's figures showing wide differences in yield between individual plots. This work will be continued until some consistency in the comparative behaviour of a sufficient number of plots in each series has been attained.

The principal agricultural station is, of course, the Dacca Farm, which is largely used by the scientific sections for field experiments. Great pains have been taken during the last two years to improve and increase the experimental area of this farm. Another year's work should make this station one of the best in India. During the year under report, a special area has been allotted to the fibre section for experimental work, for the Botanical section a tank has been excavated for the study of deep-water

paddy and a terraced area has been constructed for the study of water requirements of transplanted varieties. At Chinsura a plot of land near the farm steading is being specially raised for the study of *olitorius* jute, and exotic sugarcane varieties for the Fibre and Chemical sections. At the Rangpur Dairy Farm a special piece of high land has been levelled and laid out for the Fibre section. In the improvement of the agricultural stations the requirements of the Dacca specialists have thus not been lost sight of.

11. **Cattle Breeding.**—There is little to be said regarding this subject. The policy outlined in last year's report has been given effect to and will take some years to mature. The breeding operations are divided into two sections, and the stock now consists of two distinct herds, one consisting of Bengal bred cattle, the other of Bengal cows crossed by a Hansi bull. The number of cows has been tentatively fixed at 100 and the present strength is 99. The cows are now more or less of one type, and the young stock are in good condition. Much valuable time had been lost through the use of unsuitable bulls in the early days of the farm, but more rapid progress may now be looked for. Since the change of bulls 18 months ago, the resulting progeny are greatly in advance of any previously bred. The farm is now on sound lines, and, with the exception of the selection and casting of stock, ought to run more or less automatically with reasonably good management.

12. **District work.**—Work in the districts is growing steadily in conformity with the results achieved at the experimental stations. We have now (at the time of writing) district agricultural officers in *17 Districts* and a certain amount of district work has, in addition, been undertaken by the Farm Superintendents of Burdwan and Rajshahi.

The work consists mainly of the distribution of seed of departmentally selected crop varieties, of demonstrations of the effects of manures and arrangements for their supply, the introduction of groundnuts, and measures against *ufra* disease of rice.

I.—Seed distribution.

(*a*) *Rice.*—The scheme, as outlined in last year's report, for the widespread distribution of the premier Dacca selected transplanted variety of rice is being given effect to. It was then pointed out that we could never hope to distribute this variety effectively within reasonable time except by the widespread distribution of small quantities of seed. After a consultation with the Presidents of Panchayats of the Dacca district, it was agreed that the distribution should be done through them and that the unit of distribution should be fixed at 10 lbs. In order to facilitate distribution, the Presidents suggested that no money charge should be made, but that a quantity equal to that distributed should be returned to the Department after harvest. A distribution scheme was accordingly drawn up on these lines for the Dacca district. A similar one for Mymensingh was subsequently prepared, 2,000 maunds of the Indrasail paddy being distributed in this manner in the two Districts. Although the success of the scheme will depend largely on the extent to which the produce of the 10-lb. bags is kept for seed, it is apparent that the preservation of even a comparatively small percentage will mean a big advance on anything possible through intensive rather than extensive methods of distribution. For example, 2,000 maunds of seed paddy would produce anything from 150,000 to 180,000 maunds last year. If then only 20 per cent. of that amount were kept for further seeding, it would suffice for 90,000 to 120,000 acres in Eastern Bengal. The actual acreage figures cannot, of course, be ascertained until later in the season. The growers, however, have kept rigidly to their bargain regarding the return of seed to the department, which received back the whole quantity supplied. Considering that the number of growers amounted to thousands 100 per cent. return of seed is a remarkable figure. The programme for this year originally aimed at the distribution of a total of 6,000 maunds in most of the Northern and Eastern Bengal districts. This amount has had to be slightly reduced (to 5,300 maunds) owing to an unexpected demand from Bihar for 1,000

maunds (500 of which was supplied) and an overestimate by 200 maunds of our farm crops.

The chief difficulty now is the preservation of the purity of the seed in large quantities. Steps, however, are being taken to keep down admixture to as low a percentage as possible. The establishment of District Farms will be of great value in this direction.

As mentioned above, the *Kataktara aus* variety is out on trial in the districts. There was a great demand for this variety (which of course could not be met) in the Dacca district, doubtless as a result of the district panchayati conference which was held last year at the Dacca Farm, the *Kataktara* showing up well at the time. This paddy is being tried in the districts in both Eastern and Western Bengal.

Up to date there has been no distribution of transplanted paddy seed in Western Bengal, although the Indrasail variety has been tried with success in some localities. It has, however, been decided to distribute the seed of the Nagra variety raised on the Chinsura Farm in selected areas in Western Bengal. Nagra is a selection from a local variety passing under that name which is grown in tracts where water is plentiful. Taken all over it has proved the best yielder (according to quality) in the block tests at Chinsura. As the Deputy Director has a considerable quantity for distribution, there exists a good opportunity for testing the popularity of a locally selected seed of a high purity of sample. The experiment ought to meet with success.

(*b*) *Jute.*—The difficulties in the way of the natural spread of good varieties of jute have been explained in my last two annual reports and a logical method of meeting these difficulties has been suggested. The main difficulty consists in this, viz., that about 97½ per cent. of the crop is cut for fibre and that therefore that proportion of the produce of a seed distribution would be lost for further propagation. Progress, therefore, could only be at the rate of an arithmetical progression. As a remedy it was suggested that we should attempt to supply seed only for the 2½ per cent. represented by the seed area by giving out a large number of small packets (instead of) selling seed indiscriminately by the maund or the seer. After consulting the Presidents of Panchayats of the Dacca district, the unit of distribution was fixed at ¼ lb., the amount required to sow the "seed area" of an acre of jute. As a trial 100 maunds of the seed of the Kakya Bombai jute were accordingly distributed in ¼ lb. packets in Dacca and Mymensingh districts. As logical methods are sometimes extremely difficult in application, the result was awaited with considerable interest. The two critical points on which the success of the whole scheme depended were—(1) would the people sow the seed in a corner of their field or homestead land as recommended, and (2) would they keep the seed from this area for seed purposes. As mentioned in last year's report the seed was sown by nearly everybody who received it, but the second point was still undetermined at the time of writing the report. As it turned out, some trouble was experienced in getting the growers to understand the object in view, but this difficulty was eventually got over. A careful check carried out by the district agricultural officers in the two districts shows that over 90 per cent. of the people receiving packets of seed in 1917 have kept enough for their own requirements this year.

It is obvious that although a similar efficiency cannot be expected in all cases and in all districts, even with a much lower percentage, the distribution of a few thousand maunds of seed on the above principle would be quite sufficient to establish new varieties of jute throughout the Province.

Olitorius or desi jute.—This class of jute is grown mostly in the Western Bengal districts, where the absence of early rainfall renders the sowing season too late for *capsularis*.

As mentioned above, 12 maunds of seed of the Rajshahi selection No. 26 have been distributed for district trials in Western Bengal and arrangements have been made for a seed supply of 300 maunds for next year in the event of a demand arising for this variety—a contingency which is more than likely.

(*c*) *Sugarcane setts.*—The propagation of sugarcane, as has been pointed out before, is one of considerable difficulty in Bengal. Owing to the lower part of the cane being quite unfit for seed purposes, and the heavy seed rate

required, propagation is necessarily extremely slow. Further, propagation by setts means heavy transport. As indicated in last year's report, the principle of a wide distribution of small quantities is even more imperative than in the case of rice and jute. Indeed, in the absence of a large number of sugarcane seed farms, the distribution of improved varieties of the crop is only possible by the active assistance of local growers.

II.—Demonstration.

The seed distribution scheme outlined above is essentially a combination of a demonstration of improved crop varieties combined with the formation of a nucleus seed supply in a large number of centres. It has been decided (*indeed it is obvious*) *that demonstration of new varieties* by plot experiment *supervised by an officer of the department is unnecessary*, and the *practice has been discarded in favour of a wide distribution* of seed. There are, however, many items, such as the use of manures, implements, the growing of new crops, etc., which require plot demonstration. This work has met with some success in Western Bengal, especially in the three western districts, where the use of bonemeal, the growing of groundnuts and the value of *dhaincha* as a green manure are being systematically taken up. Mr. Smith, Deputy Director of Agriculture, reports that during the past year 1,500 bighas (500 acres) of groundnuts, 1,500 bighas of land manured with bonemeal, and 1,000 bighas with *dhaincha* were under the supervision of the local agricultural officers. Taking into consideration the small staff available for the work, the progress is satisfactory. Demonstration in Western Bengal is carried on with the assistance of District Agricultural Associations. The decentralization of the Birbhum District Association into Thana Associations for the purpose of improving demonstration work is an important step.

Still more important is the recent decision by Government to extend the scope of agricultural loans to the purchase of manures. Although times are at present unfavourable (the low price of paddy and jute rendering the economic application of manures difficult), in normal times this concession will doubtless remove one of the chief obstacles to the more extended use of fertilizers in the districts.

III.—Ufra disease.

District work with reference to this disease has, as mentioned by Mr. Hector in his report, been transferred from the Mycological section to the district staff of the department. It is obvious that we are not going to get much more useful information regarding the disease from scientific investigation, that already supplied by the Imperial Mycologist being fairly complete, or at least complete enough to act upon.

The problem is at root an agricultural one—the disease appearing as the result of an inferior method of cultivating the *bhils*. In last year's report I advocated, in addition to the standard check on the disease of stubble-burning, two lines of work, viz.:—

(*a*) The improvement of *bhil* cultivation generally.

(*b*) The avoidance of the deep-water crop altogether for one year, and the substitution of another for it.

While I am convinced that the only satisfactory solution to the whole problem lies in the direction of a general reclamation of the *bhils* owing to the danger of the appearance of other and possibly more serious diseases, it appears advisable to have at hand some ready method of combating *ufra* in addition to stubble-burning in the event of its becoming a real menace.

Work has therefore been started on the two different lines mentioned above.

In the first place, a piece of lowlying *ufra*-infected land near Pubail in the Dacca district has been terraced into two levels; and instead of simply growing deep-water *aman* paddy over the whole area the lower area has been

put under *boro* paddy, while the higher area is under jute. The *ufra* is thus circumvented, but the cost amounted to Rs. 750 per acre. On the other hand, the work could probably have been done by the occupier at a much less cost. This is mentioned as a typical method of the reclamation of a certain type of *bhil* land. I am not sure that this class of cultivation is altogether free from objection if carried out on a large scale, as I am not aware of the effects of *boro* cultivation on malaria, for instance. But from an agricultural point of view it is a decided improvement, and when it is considered that the *bhils* contain some of the best land in the country, the study of *bhil* cultivation will, I am sure, repay the trouble and expense.

As an instance of what might be done to check *ufra* in the event of a serious outbreak, the substitution of another crop for the long stemmed *aman* paddy for one year was suggested in last year's report, the assumption being that with an early harvested crop and the *bhil* kept clear of paddy during flood-time the parasite would be starved out. "Starvation" would obviously be more effective than "burning," as it could be made more complete. The district staff of the department are therefore this year trying some long-stemmed *aus* paddy varieties (such as are grown in parts of Eastern Bengal mixed with *aman* and harvested before flood time) to see what outturn can be obtained by growing the crop pure. It is improbable that we will succeed at once, but it is obvious that such a crop grown for one year by every one within a given radius in a *bhil* would result in the starvation of the parasite within that area, and probably render the area free from disease until reinfected. It would also offer the individual some protection against the disease in the event of others refusing to co-operate in preventive measures.

13. **General.**—During the last three years the Department has been able to show considerable progress. In 1915 seed distribution was confined to two districts and one variety of transplanted paddy. This year there is scarcely a district in the Province where the seed of departmentally selected varieties has not been distributed. The selected seeds now consist of three varieties of paddy and two of jute. Further, the work of the Chemical section on the analysis of soils and plant ash has greatly strengthened our hands in dealing with questions concerning manures and the food requirements of crops. We have now reached a stage where the Department can be safely expanded in the direction of producing and distributing the seed of new strains and of organising supplies of manures.

The sound work of the Dacca laboratories has put us in this position. Owing, however, to "deltaic" conditions, the use of a variety of agricultural implements, and the improvement of agricultural processes rendered possible thereby, must always be restricted. Compared with other parts of India, the North-East offers few opportunities of development on these lines. But there is another class of agricultural improvement which may, if properly developed, offer an almost unlimited field for useful work. We have already seen that *ufra* disease of *aman* paddy is no more than what can be expected from a bad class of cultivation, and, although it may be avoided by the substitution of the crop attacked by another, the real cure lies in the improvement of the *bhil* itself. Again, the possibility of extending the area under the more valuable crops, such as sugarcane, etc., is largely a question of irrigation, terracing and drainage. There are many such problems in Bengal which the Agricultural Section of the Department may be called upon to take up at no distant date. But it is clear that if the Department is to undertake work of this nature the training of the Agricultural Staff will require to be more technical than it has been in the past. Chemistry, botany, entomology, are largely educational subjects even when taken in an agricultural course. A great deal of what is ordinarily taught as "Theory of Agriculture" falls under the same category. It is, moreover, doubtful if satisfactory courses in such important subjects as "practical agriculture" and "field engineering" can be undertaken in the ordinary degree or diploma course of the colleges. At any rate, it is clear that something will have to be done to improve the technical efficiency of the agricultural side of the department, either by recruiting from those having an engineering training, or by training our agriculturists in engineering.

SECTION II.

Sericulture and Weaving.

14. **General.**—The operations for the improvement of the silk industry in Bengal were continued on the lines of previous years under the general control of a committee consisting of the Director of Agriculture, the Collectors of Murshidabad and Malda, and three Non-officials. No action has been taken on the report of Mr. Lefroy, late Imperial Silk Expert. So far as the report concerns the Bengal industry, it recommends little more than the adoption of the recommendations of the Oldham Committee of the year 1906. It is generally held that, if the *pebrine* disease of the silkworm can be successfully combatted the silk industry (at least so far as it concerns the production of silk cocoons) would still be economically sound. It is further agreed that with *polyvoltine* races the produce of disease-free worms will, even in the event of their contracting *pebrine* during their "education," succeed in spinning cocoons. As there appears to be little hope of the silk-worm-rearers in Bengal producing disease free seed for themselves the problem becomes one of producing a sufficient quantity of such seed for the industry. The department at present supplies only a small portion of the total requirements of seed for the mulberry districts in Bengal, and the problem would thus at first sight seem to consist simply in the multiplication of our present efforts. Not every type of organization, however, is capable of expansion owing to difficulties of supervision, and supervision in the present case is all-important. It is clear, therefore, that the expansion of the Sericultural Department cannot be along present lines. In fact, an entirely new type of organization will have to be evolved before any considerable expansion is possible.

Babu A. C. Ghosh held the post of the Superintendent of Sericulture throughout the period under report. He spent ~~210~~ days on tour, and constantly inspected the various nurseries. High prices have been obtained for the nursery seed cocoons which have sold at a premium over local produce. The total receipts from the nurseries for the nine months from 1st July 1917 to 31st March 1918 amounted to Rs. 32,662 against Rs. 28,737 of the preceding 12 months, due to revenue returns on an increased expenditure on manures, etc., and higher prices for "seed." The total expenditure was Rs. 61,093.

Ten boys passed from the Rajshahi Sericultural School and two from the Sericultural class at Berhampore. It is reported that most of the passed students have constructed model rearing houses and have been successful in rearing.

15 **Cross-breeding experiments.**—The hybridizing experiments initiated by M. Grangeon at Berhampore before he left for military duty in France in 1914 remained in charge of Mr. P. C. Chaudhuri, Superintendent of the Berhampore Central Nursery. The Berhampore Nursery has been temporarily set aside for testing cross-bred races on a large scale. Some of these are apparently much superior to local *nistari* races, but experience of their hardiness and immunity to disease is necessary before distributing any of them to silkworm-rearers in the districts.

16. **Other scientific work.**—Miss Cleghorn has continued her work on the inheritance of characters in silkworms. Some of her crossbred races are under trial at the Berhampore Experimental Nursery.

The new method of detecting *pebrine* in diseased moths as advocated by Mr. Hutchinson has been tried in the nurseries at Berhampore and Kurseong by Mr. Chaudhuri and found to be more accurate, although more difficult in application.

17. **Weaving.**—Mr. N. N. Pillai, Weaving Master, who spent 221 days on tour during the nine months, visited almost all the weaving centres in the Presidency. With the assistance of the co-operative Department he has been successful in introducing some definite improvements in weaving and reeling appliances. The difficulties in the way of purchase of raw materials are being met by the formation of co-operative societies and the Co-operative Department are assisting in the disposal of manufactured articles.

As pointed out last year, co-operation in purchasing and marketing is the first essential, and it is satisfactory to know that Mr. Pillai is working on these lines and obtaining every assistance from the Co-operative Department.

SECTION III.

Miscellaneous.

18. **Arboriculture.**—Progress reports of district arboricultural work for 1917-18 have not been received from all districts at the time of writing. It is therefore not possible to compare this year's figures, viz., number of new trees planted, receipts, expenditure, etc., with those of the last year.

The class for the training of overseers and sub-overseers in arboriculture was held at the Royal Botanic Garden, Sibpur, from 14th August to 13th September 1917. Eleven officers attended the course.

The revised Manual of Arboriculture is still under the consideration of Government.

19. **Statistical work.**—The number of forecasts of the sugarcane crop published by the department has been increased from two to three. The first forecast deals with area only, the second with area, prospects and outturn, and the third with area and outturn. Three regular forecasts, one special forecast, and three intermediate reports on the condition and prospect of the wheat crop have been submitted to the Director of Statistics under orders of Government. The other statistical returns were compiled according to the practice of previous years.

20. **Rainfall Stations.**—No new rainfall stations were opened during the the year, the total number in the province remaining at 230. Of these only 40 are reported to have been inspected.

21. **Implements.**—The usual appendix giving a list of agricultural implements tested has been omitted from this report. Reference may be made to the reports of the agricultural stations and of the Superintendents of Agriculture, published separately, for this information.

22. **Expenditure.**—The expenditure on miscellaneous experiments and enquiries other than those carried out in agricultural stations and for sericultural work during the financial year 1917-18 amounted to Rs. 3,35,336 as detailed below :—

	Rs.
Superintendence	63,642
Expert staff	1,97,398
Agricultural experiments	40,692
Seed stores	28,604
Cattle-fairs and shows	1,000
Special crops	4,000
Total ...	3,35,336

23. **Acknowledgment.**—Acknowledgments are again due to the very large number of Government officials and private individuals who have assisted the department throughout the year in the districts. It is not too much to say that without such assistance district demonstration work would make little headway, and no matter how the department is expanded, for certain classes of work it will always have to depend largely on non-official help and sympathy. The department is again indebted to those Calcutta jute firms who have placed land at its disposal for variety tests with jute and have undertaken the supervision and met all the expenses connected with the experiments. The thanks of the department are specially due to the members of the staff of the Pusa Research Institute for valuable assistance in mycological, bacteriological and Entomological subjects.

24. **Staff.**—Owing to expanding work and the absence of two of its members, the superior staff has had a particularly heavy year. In spite of every difficulty, however, the work has been carried on and success has been

attained in many directions. Mr. Finlow and Mr. Hector deserve much credit for the high state of efficiency of the departmental laboratories at Dacca and for the high order of the work turned out. The development of the district work of the department is largely due to the efforts of the Deputy Directors of Agriculture, Mr. Smith and Babu Rajeswar Das Gupta. The appointment of the latter to officiate in the Eastern Circle has been amply justified.

The Assistant Staff at Dacca have all worked well. Special mention may be made of Babus G. B. Pal, N. C. Basu, Mr. S. G. Sharangpani, the senior assistants in the Chemical, Fibre and Botanical sections. Amongst the Farm Superintendents the work of Babu Kali Das Ray, Superintendent of the Rajshahi Farm, deserves special mention. His successful cultivation of jute and sugarcane are special features of the year's work, and his careful control of the varietal plots of the former crop have been of the utmost value to Mr. Finlow in selecting jutes for Western Bengal. The most of the District Agricultural Officers have been recently appointed. Owing to the improvement of the pay and prospects of Class I of the Upper Subordinate Service we have been able to recruit a good class of young men for these posts.

In the Sericultural section Babu A. C. Ghose, Superintendent of Sericulture, has shown his usual energy and technical ability in the management of the seed nurseries. The work of Mr. P. C. Chaudhuri which is highly appreciated by the Silk Committee, is also deserving of mention.

B. S. Press—17-6-1918—778J—750—J. L. C.

GOVERNMENT OF BENGAL.

REVENUE DEPARTMENT.

Agriculture Branch.

RAMNA (DACCA), THE 24TH JULY 1918.

RESOLUTION—No. 759 T.R.

READ—

(*i*) The Report of the Department of Agriculture, Bengal, for the year ending the 31st March 1918.

(*ii*) The Reports of the Expert Officers of the Department for the same period.

THE period covered by the annual report of the department has been altered from the year ending the 30th June to that ending the 31st March, because the 30th June falls in the middle of the season of the autumn crops. The period under review this year is, therefore, one of nine months. On the 1st March 1918 the headquarters of the Director of Agriculture were transferred from Calcutta to Dacca. The scientific work of the department has become largely centralized at the Dacca Farm, and it is, therefore, advantageous that the Director should be in very close touch with the work carried on there. Mr. S. Milligan was in charge of the department throughout the year. The Presidency is still without the services of Mr. Annett, Agricultural Chemist, and Mr. McLean, Deputy Director, Eastern Circle, who have been absent since the autumn of 1916, the former on work connected with the war, and the latter on military duty. Babu Rajeswar Das Gupta, Superintendent of Agriculture, was appointed to officiate for Mr. McLean in the Eastern Circle in November 1917, and the Governor in Council is pleased to observe that in the opinion of the Director his promotion has been justified. Mr. F. Smith was in charge of the Western Circle throughout the year; and Mr. Finlow, Fibre Expert, supervised the work of the Chemical Section throughout the period under report and that of the Botanical Section until Mr. Hector's return from leave in October 1917. As in previous years there was a Superintendent of Agriculture in each of the five divisions. The number of District Agricultural Officers on the 31st March 1918 was twelve, or three in excess of the number on the 30th June 1917. In January 1918 the Government of India approved of a scheme for the formation of a service of District Agricultural Officers. In submitting this scheme the Governor in Council expressed the opinion that an agency of this nature is an essential element in agricultural progress in Bengal, and contemplated the ultimate appointment of a District Agricultural Officer in every district, and the establishment at the headquarters of each district of a small farm of which the Agricultural Officer should be in charge. The reports now under review indicate the extent to which the District Agricultural Officers employed in 12 districts and the farms at Chinsura, Burdwan, Rajshahi, Rangpur and Kalimpong, apart from the Central farm at Dacca, have contributed to the progress attained up to date.

2. The number of students from Bengal at the Sabaur College was 17 as in the previous year. Mr. Milligan remarks on the importance for agriculture in Bengal of questions of irrigation, terracing and drainage and on the need for improving the technical efficiency of the agricultural as distinct from the scientific side of the department, either by recruiting from those having an engineering training, or by training agriculturists in engineering.

3. The normal area under rice in Bengal is 22,024,600 acres, the most important crop being winter rice which represents 75 per cent. of this area, while autumn rice accounts for 23 per cent. and summer rice for 2 per cent.

Satisfactory progress has been made in extending the distribution of *Indrasail* seed for transplanted winter rice. In 1917 2,000 maunds were distributed in 5-seer packets in the districts of Dacca and Mymensingh on the condition that an equal quantity of seed should be returned to the department. This condition has been strictly fulfilled; and if, as is hoped, at least 20 per cent. of the produce has been reserved by the cultivators for use as seed in 1918 sufficient seed will be available for 100,000 acres. Arrangements have been made for the distribution of 5,300 maunds of *Indrasail* seed on the same lines in 1918. The *Nagra* variety of transplanted winter rice has proved successful at the Chinsura Farm and arrangements have been made for initiating its distribution in the same manner in Western Bengal. *Kataktara* autumn rice which has done well at the farms is now under trial in districts of Western and Eastern Bengal with a view to subsequent distribution if results are satisfactory. The examination of long-stemmed deep-water varieties of winter rice in a special tank at the Dacca Farm has been initiated during the past year. Remedies for the *ufra* disease of broadcast winter rice have continued to receive the attention which they deserve, and the Mycological Collector has been chiefly employed on this work. The scientific study of the parasite has been further pursued by the Imperial Mycologist at Pusa. As explained in last year's report it has been established that the parasite survives in the stubble from year to year between harvest and sowing. The remedy is to deprive the parasite of the stubble on which it lives, and the problem is to find means for applying this remedy. The problem is sought to be dealt with by two alternative methods, the removal of the stubble by burning and thorough cultivation, and the elimination of the stubble by substituting a different crop. Moderate success has been obtained in *ufra*-infected fields by stubble burning, but the crops on the fields so treated are liable to infection from neighbouring fields. At Pubail, a place notorious for *ufra* in Dacca district, a piece of low-lying land was terraced into two levels, and in place of deep water winter rice, summer rice was grown on the lower area and jute on the higher area. The cost of this work as carried out by the department was prohibitive; but the experiment may induce cultivators to try similar methods for themselves, and they can probably do the work more cheaply. As Mr. Milligan observes, existing methods of *bhil* cultivation are primitive, for the land hardly becomes dry before the sowing season, and the problem is to a great extent one of field engineering.

4. The crop of second importance to rice in Bengal is jute which is normally grown on an area of 2,643,800 acres. The *Olitorius* variety is grown in the Presidency and Burdwan Divisions and in Rajshahi district of the Rajshahi Division, and the *Capsularis* variety in the Dacca and Chittagong Divisions and in the remaining districts of the Rajshahi Division. One hundred maunds of the selected *Kakya Bombai* seed (*Capsularis*) were distributed in 1917 in $\frac{1}{8}$-seer packets in Dacca and Mymensingh districts on the condition that the recipients should sow the seed separately and keep the whole of the produce for seed for the next year, the produce of 1917 being estimated to give sufficient seed for an average jute holding in 1918. Special care was taken to explain what was intended; and it is satisfactory to learn that 90 per cent. of those who obtained seed kept enough for their own requirements this year, and that seed sufficient for 30,000 acres was in the hands of cultivators of Dacca and Mymensingh at the beginning of 1918. About 600 maunds have been similarly distributed in 1918 in these two districts and in the remaining important *Capsularis* districts of Tippera, Faridpur, Rangpur, Pabna and Bogra. The tests of *Kakya Bombai* against local varieties initiated in 1916 on fields provided by the local agencies of jute firms were continued in 1917, the comparative plots being reversed. In 1916 the average superiority of *Kakya Bombai* was 3 maunds per acre, and in 1917 it was 2 maunds per acre, giving a net average superiority of $2\frac{1}{2}$ maunds, a result which has more than justified Mr. Finlow's claim that his selected seed was better than average local varieties by $1\frac{1}{2}$ maunds per acre. Tests at Chinsura and Rajshahi have established as suitable for Western Bengal and Rajshahi a variety of *Olitorius* jute, known as R. 26; and 12 maunds of seed were distributed in small packets for sowing

in 1918. Among experiments with manure for jute those in connection with potash are of the greatest interest. The efficacy for jute of potash obtained from the water hyacinth has been established, and potash has been found to be a preventive of the disease Rhizoctonia, which is a phenomenon of potash starvation common in the red soils of Eastern Bengal. Further experience with water hyacinth ash has shown that stunted hyacinth plants do not contain a high enough proportion of potash to make it profitable to convert them into ash for sale, and that such plants should be rotted and used locally for manure, only deep water plants being converted into ash. The soil survey of the Presidency has been continued : as would be expected the old alluvium (red laterite soil) has the most marked deficiencies, the red soil of Eastern Bengal lacking phosphoric acid, lime and potash, and that of Western Bengal lacking the two former elements. Mr. Finlow has been led by the shortage of flax to make experiments with sunn hemp which promise valuable results. Jute is not strong enough as a substitute for flax for the manufacture of canvas, and sunn hemp in its normal state is too rough for spinning. Mr. Finlow has elaborated a softening process which makes sunn hemp fibre suitable for spinning, and the suitability of the thread for canvas is now under investigation.

5. The work on sugarcane has shown satisfactory progress. Out of 51 varieties selected for tests, 41 have been eliminated. The tests which are applied are sugar content and fitness for local conditions, which vary greatly throughout the Presidency. Among exotic canes Yellow Tanna and Java 247 have proved successful and of local varieties *Gandari* (Dacca), *Vendamukhi* (Rajshahi) and *Samsara* (Burdwan) are the most popular. The exotic canes give the best yield but are inclined to deteriorate. There is an increasing demand for sugarcane cuttings from the Government farms, and though nearly 500,000 were distributed during the year the demand far exceeds the supply. New farms at district headquarters will facilitate the supply of this demand. In the meantime the assistance of local agriculturists in growing superior cane with a view to the distribution of cuttings by sale is much needed ; and the Governor in Council would be glad if members of Agricultural Associations would undertake this business of distribution.

6. The policy laid down by Government for the Rangpur Cattle Farm is being followed. During the year a pedigree Hansi bull was purchased from the Cawnpore Military Dairy Farm, and there are two full grown Bengal bulls, and 99 cows on the farm. Seventy-one cows were purchased during the year to replace those which were not considered to be of good enough quality. Two distinct herds are maintained, one of indigenous cattle and the other of cross bred : the change of bulls is reported to have brought about an improvement in the stock. On the cultivable area of the farm fodder crops are now chiefly grown.

7. The report affords evidence of the increasing interest which is being taken by the general public in the work of the department. The assistance of the local agents of jute firms has been invaluable to Mr. Finlow in testing his *Kakya Bombai* seed. The good work of the District Agricultural Associations of Rangpur, the 24-Parganas and Malda, of the Thana Agricultural Associations in Birbhum, and of the Panchayats in Dacca district has earned the thanks of the officers of the department. Mr. Smith's report shows that the District Associations in most districts of Western Bengal suffer from the want of District Agricultural Officers to help them in their work. He reports that in each district there are earnest workers whose numbers can easily be increased when officers are available to help them.

8. The continued rise in the prices obtained for home reeled silk is reported to have resulted in a considerable increase in the area under mulberry in Bengal. The effects of improved prices are also shown in the financial results of the supply of seed-cocoons from the Government nurseries, the receipts for the nine months under review being Rs. 32,563 compared with Rs. 16,829 and Rs. 28,737 in the full years 1915-16 and 1916-17. Nevertheless Babu A. C. Ghose, the Superintendent of Sericulture, reports that the silk industry is rapidly disappearing in Bogra district on account of the high wages of labour and the superior attraction of jute. Sericultural work was continued on the same lines as in previous years. The new features of the

work were the introduction of the more accurate method of detecting pebrine in moths advocated by the Imperial Agricultural Bacteriologist, and the setting apart of the Sericultural Nursery at Berhampore for testing on a practical scale the races of silk worms which have been reared by Mr. P. C. Chaudhuri, who is carrying on M. Grangeon's work, and by Miss Cleghorn. The results of these trials will be awaited with great interest. The Governor in Council has not yet received the opinion of the Provincial Silk Committee on the recommendations of Mr. Lefroy, late Imperial Silk Expert.

9. The report of the Weaving Master is of special interest this year on account of the widespread efforts which are being made to revive the home spinning and weaving industries as a remedy for the shortage of cotton cloth. Mr. Pillay has endeavoured to introduce improved "Charkas," or spinning wheels, and looms, and he assisted the Tippera District Board in the equipment of a new technical school, and supplied model "Charkas" which are now being produced locally. In the Kishorganj subdivision of Mymensingh district he introduced flyshuttle looms and the weavers are now turning out *dhotis* and *saris*. In consultation with the Co-operative Department he has assisted the purchase of raw materials and the disposal of manufactured articles. Mr. Pillay's report shows that he has visited all the principal weaving centres in the Presidency and has given much practical assistance, and the Governor in Council has no doubt that his efforts will be widely appreciated.

10. Mr. Milligan's report speaks for itself of the many-sided activities of the department which is in his charge and of the valuable work which is being done. The Governor in Council has much pleasure in acknowledging his services and those of the officers who have assisted him, and the support which has been given to him by numerous private individuals.

By order of the Governor in Council,

L. BIRLEY,

Secy. to the Govt. of Bengal.

No. 6182,

COPY forwarded to the Director of Agriculture, Bengal, for information.

By order of the Governor in Council,

M. A. MOMEN,

Under-Secretary to the Government of Bengal.

RAMNA (DACCA);
REVENUE DEPT.—*Agri.*,
The 24th July 1918.

B. S. Press—29-7-1918—1200J—1,600—S. C R.

REPORT

ON THE OPERATIONS OF THE

DEPARTMENT OF AGRICULTURE, BENGAL,

FOR THE YEAR

1918-19.

CALCUTTA :

THE BENGAL SECRETARIAT BOOK DEPOT.

1919.

DEPARTMENT OF AGRICULTURE, BENGAL.

No. 250-C.

FROM R. S. FINLOW, ESQ., B.SC., F.I.C.,
Offg. Director of Agriculture, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,
REVENUE DEPARTMENT.

Dated Camp Darjeeling, the 11th June 1919.

SIR,

I HAVE the honour to submit the Annual Report of the Agricultural Department, together with the reports of the expert officers. for the year 1918-19.

2. Mr. Milligan drafted the greater portion of the Director's review before his departure; the remainder is mine.

I have the honour to be,
SIR,
Your most obedient servant,
R. S. FINLOW,
Offg. Director of Agriculture, Bengal.

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REPORT

OF THE

AGRICULTURAL DEPARTMENT, BENGAL,

FOR

1918-19.

INTRODUCTORY.

In previous years the Annual Report of the Agricultural Department, *i.e.*, the Director's review, and the respective reports of the expert officers of the Department, were published separately. Under the orders of Government all the reports for the present year are issued in one volume and this procedure will also be observed in the future.

SECTION I.—AGRICULTURE.

Administration.—Mr. S. Milligan remained in charge of the Department throughout the year. Mr. F. Smith continued as Deputy Director of Agriculture, Western Circle, till the end of January, when he went on combined leave and Babu Rajeswar Das Gupta succeeded him. Mr. K. McLean returned from military duty early in February, and resumed charge of his duties as Deputy Director of Agriculture, Eastern Circle. During Mr. McLean's absence, Babu Rajeswar Das Gupta acted as Deputy Director of Agriculture, Eastern Circle. Pending the appointment of a third Deputy Director of Agriculture for the Northern Circle (Rajshahi Division), Babu Rajeswar Das Gupta has been placed in charge of the circle in addition to his own duties. Mr. R. S. Finlow was in charge as Fibre Expert throughout the year. He also supervised the chemical section, in the absence of Mr. H. E. Annett, whose services are still at the disposal of the Government of the United Provinces. Mr. G. P. Hector held the post of Economic Botanist throughout the year.

Maulvi Wali-ul-Islam, Personal Assistant in the Director's office, reverted to the Provincial Executive Service and some changes in the personnel of the Provincial Agricultural Service were necessary in consequence. Dr. N. Gupta, Superintendent of the Rajshahi Division, was placed on special duty as Personal Assistant to the Director, and Mr. J. N. Chakravarty, Superintendent of Agriculture, took up his (Dr. Gupta's) work in the Rajshahi Division. Mr. D. Dutt, Superintendent of Agriculture, Chittagong Division, was put on special duty at the Dacca Farm, in connection with the establishment there of an Agricultural Middle School, and Babu Kali Das Roy of the Subordinate Agricultural Service was appointed to act as Superintendent in Chittagong.

The staff of District Agricultural Officers has been strengthened and now numbers 26, there being one officer for each district of the Province, excepting the Chittagong Hill Tracts.

Tours.—Mr. Milligan was on tour for 85 days during the year. Mr. Smith spent 173 days on tour during ten months. Babu Rajeswar Das Gupta was on tour for 326 days. The Fibre Expert spent 80 days and Mr. Hector 79 days in the districts. The Superintendents of Agriculture and the District Agricultural Officers were continually on tour in pursuance of their respective duties.

Agricultural Education.

The Principal of the Agricultural College at Sabour reports that during the session 1918-19 there were 32 students from Bengal, 29 in the 1st year and 3 in the 2nd year. Of the latter, two were successful in the Certificate Examination held in March last. One student, who was sent to Sabour last year with a Government stipend, has been removed from the college as he failed to pass the annual examination of the 1st-year class. The Bengal students included holders of four scholarships, awarded respectively by the District Boards of Mymensingh, Pabna, Jessore and Tippera, besides a special scholarship granted by the Bengal Education Department. As in the previous two years, the Maling Grant scholarship remained vacant, there being no student from the St. Andrew's Colonial Homes, Kalimpong, to take it.

Reports have been received from the Education Department regarding the progress of Nature Study in Primary Schools and the Agricultural classes in Secondary Schools. There is nothing to add to last year's remarks on this subject.

A scheme for the establishment of two Agricultural Middle Schools, one in Western and one in Eastern Bengal, received the sanction of Government during the year. The places selected for the purpose are Dacca and Chinsura, where the principal Agricultural Farms of the two areas are situated. The object of the schools, broadly speaking, is to train pupils in improved methods of purely practical agriculture. The course will, as far as possible, be framed in such a way as to induce no ambition in the student to desert his calling as a farmer, and it is hoped that most of the pupils will return to their homes to make practical use of what they have been taught. The construction of the buildings of the Dacca School will be completed in July. The buildings of the Chinsura School have not been started yet. As the recruitment of suitable teachers, and their preliminary training, will require some time, the schools are not likely to be opened before January 1920.

Research and Experiment.

Fibres—Jute.—This crop continues to be the chief item in the programme of the work of the Fibre Section of the Agricultural Department. The report of the Fibre Expert on this crop contains much that is of interest. It was stated last year that, with reference to the incidence of *chlorosis* in jute plants, there appeared to be a considerable variation in the resisting power to this disease, on the part of various races of jute. Two races were found last year to be completely immune; also plants scattered throughout the pure line plots were found to be free from the disease. Seed of selected single plants was grown separately this year, together with the two races which showed immunity to this disease. The latter continued to show the same character with regard to immunity as they did last year. The produce of single plants on the other hand behaved in different ways, some exhibiting immunity while others were attacked by the disease. It would thus seem that immunity of the plants to disease is hereditary in character. Attempts were made last year to co-relate shallow rooting with immunity, and although this year's work has not been altogether conclusive on that point, there seems to be some connection between the two. The work is very important, as there is considerable danger of the spread of the disease.

Distribution of small quantities of the seed of varieties of jute.—One thousand five hundred maunds (55 tons) of the seed of Kakya Bombai jute was raised in the season 1918, and the system of distributing small quantities of ¼lb., for multiplication by the ryots themselves—*vide* previous reports—was continued. The amount given out in this manner was 692 maunds, *i.e.*, 221,000 ¼-lb. bags, against 100 maunds, in 32,000 ¼-lb. bags, in 1917; while from Dacca and Mymensingh, the operations were extended to the districts of Tippera, Noakhali, Faridpur, Bakarganj, Malda, Pabna, Rangpur, etc. The results, on the whole, were satisfactory, although, instead of 100 per cent. efficiency in 1917, the percentage figure for the year under review was only 50. This means that practically every cultivator in the Dacca and Mymensingh districts, to whom Departmental seed was given in 1917, kept his promise and grew the resulting crop for seed. In 1918, in the extended area detailed above, only 50 per cent of the cultivators, who received seed, grew a seed-crop of jute. A diminution of efficiency was only to be expected, for while the Department is well known in the Dacca and Mymensingh districts, it had done no previous work in several of the new districts to which distribution was extended in 1918. Moreover, District Agricultural Officers had only just been appointed to the latter.

If seed were sold, or distributed, in large quantities, in the ordinary way, without any undertaking by the ryot in regard to seed production, about 97½ per cent. of the resulting crop would be cut for fibre, and thus only 2½ per cent. of the original seed is available for multiplication. Even the 50 per cent. efficiency of the distribution scheme in 1918 is 20 times more effective than this; already through its agency about 100,000 acres of Kakya Bombai jute are being grown in the present season and there is thus good reason to be satisfied with a system which well enable the Department to cover the whole jute area, in a few years, with any kind of seed it wishes. By no other means does it seem possible to appreciably affect the yield of jute within a reasonable time.

Cultivators seem to be well satisfied with the Kakya Bombai seed. The chief difficulty consists in getting them to realise that we have only comparatively small quantities of it, and that the organisation of a very large supply is practically out of the question. Our District Officers are therefore besieged by a large number of applicants for seed, whom it is impossible to supply in full. It is perhaps better that the people should learn that seed of new varieties cannot be supplied in bulk, and that they will have to do one year's propagation themselves. Some of the most satisfactory results have been obtained in the district of Faridpur, where people are not in the habit of growing their own seed. In order to obtain Kakya Bombai seed at all, many have been forced to grow their own requirements round about their houses. They are thus, for the first time, practically independent of outside sources of supply—an undoubted advantage in a year like the present.

District reports speak of the excellent prices obtained by growers of this new variety. No pretensions are made by the Agricultural Department with regard to quality, and the premiums obtained for the Kakya jute, on account of its quality, are probably due to its late flowering habit.

The advantages of this were fully discussed in last year's report, where it is stated that the general adoption of late flowering varieties would, in all probability, tend to improve quality. Distribution of seed has been practically finished in the Dacca Division, and the results will be awaited with some interest, as there are prospects of our having one or two new varieties ready for distribution in a short time. The question as to whether the present method of distribution should be followed in future, will depend on the success of the present experiment. It has, however, been conclusively proved that the system of distribution adopted is economical and very effective.

Corchorus Olitorius.—Variety tests with pure lines of C. Olitorius were continued at the Rajshahi and Chinsura Farms and also at Messrs. Sinclair, Murray's agency at Narayanganj. The plots were not so successful at either of the former places as at Rajshahi in 1917. R. 26 seems to have kept its place at the head of the previously tested races, but a new race (Chinsura

green), included for the first time in the test, did extraordinarily well at all three places and beat R. 26. Further trials are being made in the present season (1919).

About 150 maunds (5 tons) of the seed of R. 26 was raised, during the year, for sale and distribution.

Manures for Jute on the Red Soils.—This investigation was referred to at length in last year's report, but even more striking results were obtained in the year under review. There is reason to believe that, by the application of lime, bone and potash to a rotation of jute and aus paddy on the red soils, the value of the increased crops represents, on the average, about double the amount of money spent on these manures. The results are now considered well established and arrangements are being made to demonstrate them to cultivators forthwith. Full details are given in the report on the work of the Fibre Expert's Section.

Water Hyacinth.—In the Fibre Expert's Sectional Report reference was made last year to the extraction of pure potash salts from the ash of the Water-Hyacinth (Eichornia Crassipes), which is becoming a serious pest in North-East India.

During the dry weather season, 1918-19, extraction apparatus was erected at Narayanganj and at Sonaimuri (Noakhali), and about 6 tons (160 maunds) of chloride of potash were extracted from the ash by lixiviation. The heat of the burning plant was utilised to evaporate the resulting solution to crystallizing point. The process worked well, and no difficulty was experienced in producing salt averaging about 90 per cent. purity. Nevertheless, owing to various causes, the value of the salt produced was not much more than half the total amount of money spent, and it seems fairly obvious that the extraction process would only be a commercial proposition in the case of such a serious shortage of potash salts as would involve a considerable rise in their price.

Botanical Section—Rice.—Details of the work on rice are to be found in the Annual Report of the Economic Botanist, whose chief work has hitherto been concerned with this crop. The work of classifying and testing the aus and the transplanted varieties of rice has been continued. As mentioned in last year's report, a beginning has been made with deep-water rice, which is mostly found in the low-lying areas in the east and south-east of the province. This is the crop which is subject to *Ufra* and, in dealing with it from the botanical point of view, the question of the avoidance of the disease, through various measures, will be included. It is probable that such provisions as we have been able to make at Dacca will not be satisfactory for anything but preliminary classification—the conditions are rather too artificial, but once the classification has been made, it will be possible to continue the work on the District Farms.

Transplated Aman Paddy.—The result of the work at head-quarters this year shows that we have about half-a-dozen varieties of aman paddy, which may be placed in the first class as regards yield. There is a considerable drop between these and the remainder. The *Indrasail* variety, which has been distributed in the districts of Eastern and Northern Bengal, still stands amongst the best of the collection at Dacca. The season was a bad one for distribution, as many seed-beds were destroyed by abnormally early floods. *Indrasail*, however, has done exceedingly well and has successfully contested the field in several localities, where it was not expected to be able to compete with local varieties. The only apparently unsuitable conditions are where the water is brackish.

Aus Paddy.—As mentioned in last year's report, seed of the *Kataktara* variety, which had done so well at Dacca, was issued to nearly all the districts which grow aus paddy. It has met with remarkable success. Not only is it a heavier yielder than any variety tested against it, but the quality of the rice is much superior to that of ordinary aus rice. It is therefore popular among the growers, and a very large demand has arisen round centres where it was demonstrated last year. It is quite impossible to meet this demand in one year, and a separate organisation, for a local supply for each district, has become necessary. It will not be possible

to distribute aus paddy in the small quantities, according to the scheme which has been so successful with aman, the reason being that aus paddy land is nearly always contaminated with shed grain of the previous crop. It is, therefore, difficult to keep the new variety pure. In these circumstances local concentration will be resorted to, and 688 maunds (25 tons) of *Kataktara* have been distributed on these lines in the present season. Now that we have District Agricultural Officers in all the districts, it is a comparatively easy matter to put this scheme into execution. Storage facilities for aus paddy seed will be one of the most important questions, as the seed has to be kept from harvesting time in August till sowing time in March or April. The interval between harvest time, and sowing the next crop of aman rice, is in the dry weather season. In the case of aus paddy however the period embraces a part of the monsoon, and water-tight conditions for storage are necessary.

Kataktara is one of a group of three or four varieties which stand at the head of the aus rices in respect of yield and quality. It is closely followed in yielding power by the *Surjamukhi* variety and, as one or two strains of the latter appear to possess some advantages in the way of straw, it is by no means certain that *Kataktara* may not ultimately be substituted by *Surjamukhi*.

Experiments with Kataktara Paddy in Bankura.—Somewhat unexpected results of a very promising nature were obtained last season with *Kataktara* rice in the Bankura district in Western Bengal. As is well known, a considerable part of the Burdwan Division, of which Bankura is typical, consists of rolling country, in which the rainfall is, on the whole, precarious and practically confined to the monsoon period. Partly owing to this, and partly to the nature of the soil, rice is often practically the only crop, and its cultivation is carried on in terraced fields, of which the upper ones are practically at high land level. In the latter, the cultivator has grasped the necessity of growing earlier ripening races of rice than in the lower fields, but the crop in the higher fields is always precarious and frequently fails in a year of short rainfall. The result is that Bankura is always a potential famine district.

In the last season, which witnessed a particularly early cessation of the monsoon, small amounts of *Kataktara* paddy, which is cultivated as a broadcast high land rice in Eastern Bengal, were sent to Western Bengal for trial. The District Agricultural Officer of Bankura, who showed commendable initiative, decided to try it, as a transplanted rice, in the higher lands already referred to. The results were most encouraging, for the *Kataktara* not only ripened earlier than the other races tried against it, but also yielded considerably more grain. Confirmation is of course needed, but the matter is one of such obvious importance that the Superintendent of Agriculture in the Presidency Division, who has some knowledge of Botany, has been temporarily relieved of his regular duties, in order that he may be free to investigate it, in collaboration with the Economic Botanist. There is little doubt that a sufficiently early ripening paddy would go a long way towards solving the difficult agricultural position in Bankura, and the results of the present season's work in this direction are being awaited with more than ordinary interest.

Chemical Section—*Soil Survey.*—The work in connection with the Provincial Soil Survey is proceeding, and there is little to add to last year's remarks, except that a special study is at present being made of the various experimental manurial plots on the Dacca Farm. These plots are a permanent feature of the work of the Farm, and very careful records of them have been kept since their commencement—in some cases approaching ten years ago. There is little doubt that the thorough work which is being done in this investigation, not only on the soils, but on the chemical composition of the crops which grow on them, will ultimately throw a good deal of light on the mechanism of plant nutrition, about which so little is known.

Sugarcane.—Last season's experiments at Dacca gave valuable results, in spite of the bad moisture conditions at the end of the season. Considerable progress was made with the survey of local varieties and some of the latter show decided promise. Of the exotics J. 247 gave the best results;

nevertheless, Yellow Tanna, which is a good yielder and also hard enough to be jackal-proof, is popular amongst cultivators, and a genuine demand for it exists.

All canes to be used for planting were again carefully selected against insect and fungus diseases.

Entomology.—The Imperial Entomologist at Pusa rendered, as in previous years, the necessary assistance in the way of identifying pests, suggesting remedial measures, preparing and supplying magic-lantern slides of injurious insects, etc.

In conjunction with the Mycological Collector, the Entomological Collector did useful work in selecting the cane setts against disease before they were planted. The result was a particularly healthy crop. Other work was in connection with the mango weevil, the hitherto obscure life history of which is now being worked out.

The Entomological Collector also attended several agricultural exhibitions where insect-pests were shown, their life history explained and the use of entomological appliances demonstrated.

Mycology.—An account of the work of the Imperial Mycologist, so far as Bengal is concerned, is published as an appendix to this report. The *Ufra* disease of rice received Dr. Butler's attention as in previous years. In collaboration with Mr. Finlow, an investigation is being made into the effect of environment on the incidence of some fungus diseases of plants, including the wilt disease of *rahar* (Cajanus Indicus) and the black band disease (Diplodia Corchori) of jute.

Most of the time of the Mycological Collector was occupied in connection with *Ufra* and the results of his work are embodied in his report. Other work included detection and treatment of fungus diseases of jute, paddy, sugarcane, cotton, etc.

Agricultural Stations.—The important work of improving the existing farms, on the lines detailed at some length in last year's report, continues and is largely increasing the capacity of these stations for valuable experimental work. In conformity with the policy of Government, whereby it is intended that there shall be a Departmental Farm in every district, three new farms have been established at Mymensingh, Comilla and Bogra respectively. They will be ready for work in the coming cold weather season.

Cattle-breeding.—The Rangpur Cattle Farm has been improved, almost out of recognition, by the recent change in the system of management, and now ought to be in a position to furnish the necessary information regarding the improvement of the breed of cattle in the Presidency—that is whether the importation of outside blood is necessary or advisable. Until this question is answered it would be a waste of time to extend the present operations.

There is little to report on the current year's work. The herd, as previously explained, consists of two sections, in which *desi* and imported Hansi bulls are respectively used.

The difficulty with regard to the purely *desi* herd is as regards the supply of bulls (this is, of course, the reason for the trial of the alternative policy of using pedigree cattle from up-country). Owing to the large amount of crossing which goes on in the villages, it is never certain, from its appearance, whether any particular bull will breed true to type. An illustration of this is to be found in our experience at Rangpur. A good-looking bull of a desirable type, bred from a good mother, was used last year for the first time in the *desi* herd. The resultant stock are all bad; none of them true to type and all contain undesirable characteristics, apparent in neither of the parents. It thus seems that, in this herd, a great deal of casting will be necessary before pedigree can be arrived at. On the other hand it is expected that the necessity for casting will be, to a great extent, reduced in the case of the progeny of the Hansi bulls, which do possess fixed characters.

District Work.

The year has been marked by a general development of district work. Interest in agricultural matters seems to be awakening and many applications for advice are received.

There is now a District Agricultural Officer in each of the 26 districts of the Province, and several other temporary officers of similar calibre have been appointed for special work. Besides the District Agricultural Officers, there are at present 79 demonstrators, and it is proposed to gradually increase the number of these, as the expansion of work justifies it. As mentioned in last year's report, the distribution of seed of departmentally selected crop varieties continues to be the main item of district work, and this is attaining to very considerable proportions in Eastern and Northern Bengal. Varieties of both rice, jute and sugarcane, which are suitable for cultivation in Western Bengal, are however now available, and the dissemination of these is being carried out by the largely increased district staff which has been given to Western Bengal.

Yellow Tanna sugarcane is a hardy and popular variety for which there is an increasing demand all over the Province.

Other items of district work are demonstrations of the effects of manures, *e.g.*, bonemeal for paddy; the introduction of ground-nuts into Western Bengal; and measures against the *Ufra* disease of rice.

Seed distribution—Transplated Aman Paddy.—A scheme for the extensive distribution of the seed of improved varieties of jute and paddy has been outlined in the two previous Annual Reports. It was recognised by Mr. Milligan some years ago, that one of the inevitable results of the war would be a serious depletion of food stocks throughout the world and that, owing to the consequent rise in prices, there would be an increased demand for high yielding varieties of food crops. Further, a bad crop year in India would be more serious than in normal times. It was, therefore, the clear duty of the Department, which happened to be in possession of several valuable strains of rice, combining high yielding power, with other desirable and necessary qualities, to so anticipate events as to be in a position to supply such a demand should it arise. It was obvious that any sudden demand for seed can never be met, and therefore it was necessary to prepare a seed-supply by a wide dissemination of Departmental seed. This has the double advantage of giving the villagers an opportunity of finding out whether the new variety suited their conditions, and at the same time providing sufficient seed locally for all practical purposes. In 1918, therefore, it was decided to extend the system, already applied in the Dacca and Mymensingh districts, of distributing small quantities (10 lbs.) of the seed of our best all-round transplanted paddy (*Indrasail*), over wide areas, in other districts in Eastern and Northern Bengal, where there were undeniable indications of this variety being generally suitable. In this way *Indrasail* has been established in a large number of new centres.

The process is being repeated in the present year, in which over two thousand maunds (75 tons) of *Indrasail* have been distributed in 10-lb. lots, *i.e.*, 16,639 parcels; but apart from this, news comes in from all sides that cultivators who possess *Indrasail* are supplying their neighbours with seed. In the case of jute, the commercial staple is the fibre and the seed is only obtained by sacrificing fibre. The cultivator, therefore, does not ordinarily grow any more jute seed than he expects to use himself, and there is consequently very little natural spread of jute, due to circulation of seed among growers. With paddy, however, and indeed with practically all Indian field crops, excepting jute and hemp, tobacco, etc., the commercial article is the seed. The very great difficulty of special arrangements for the production of jute seed is thus avoided in the case of grain-crops; on the other hand, the tendency of the latter to spread naturally, as *Indrasail* paddy is known to be doing, makes it impossible to estimate, at any time, the actual area under a new variety in course of distribution. All that can be said is that its progress is considerably more rapid than would be attained by the distribution scheme alone. Having regard to this, it is probable that there are now about 250,000 acres under *Indrasail*. As the *Indrasail* probably yields 3 maunds (240 lbs.) per acre more grain than the average of local races it replaces, we may conclude that, as a result of Mr. Hector's work, the grain-supply of Bengal has already been increased by about 7½ lakhs of maunds (about 28,000 tons) per annum, or sufficient to supply at list 100,000 people

with rice. Such facts are more likely to receive due consideration in a time of scarcity like the present than they might otherwise do.

Aus Paddy, Jute.—The distribution of the seed of *Kataktara* aus paddy has already been dealt with (*vide* page 5); and the same applies to jute (*vide* page 3).

Ground-nut.—The area under this new crop continues to expand in the Burdwan Division, as demonstrations show its possibilities in new centres. The distribution of small quantities of seed is being carried out on the same lines as have been successful with jute and transplanted aman paddy.

Tobacco.—The improvement of the tobacco crop has, for a number of years, been under investigation at the Agricultural Station at Burirhat, in the district of Rangpur. The Sumatra tobacco continues to give high revenues, amounting to over Rs. 2,000 per acre. The classification of the *desi* varieties is beginning to yield results. One of the varieties has done remarkably well in the Dacca Division, beating the local varieties with ease in regard to yield. There thus seems to be considerable scope for the best Burirhat selections, and it is satisfactory that we have been able to add tobacco to our already increasing improved crop varieties.

Sugarcane.—It is now the accepted policy of the Department, that propagation of sugarcane must be done locally, in order to avoid expense, and damage to the setts in transit. District Agricultural Officers have therefore been instructed to make themselves independent as regards their seed supplies, and to encourage seed propagation at various centres. This has been adopted to a certain extent, but there still exist difficulties in the way of inducing unofficial agencies to retain setts for sale to others. This will doubtless be overcome as time goes on. With a properly-equipped testing-station at head-quarters, and local propagation, work on sugarcane varieties will become simple and easy of management. The general principle of local propagation must be insisted on, as it is the only means of securing a quick enough dissemination of improved varieties to make the investigation worth while.

Cotton.—Owing to a marked rise in the price of cotton-goods, a very widely-spread desire for cotton cultivation was evinced by people all over Bengal. The question of cotton-growing accordingly formed a subject of discussion at the meeting of the Provincial Agricultural Association, held in July 1918, and the general conclusion arrived at was that the cultivation of cotton in small quantities might be encouraged. On the recommendation of the meeting, Government agreed, as a special measure, to finance a free distribution of cotton-seed. As it was too late then to indent good seed from outside for September sowing, a quantity of seed obtained locally was distributed in places to meet pressing demands. Arrangements were also made with the Director of Agriculture, Bombay, to obtain a supply of Dharwar American cotton-seed for April sowing. This seed duly arrived and has been distributed.

A few general remarks regarding cotton cultivation in Bengal may be of use to those who are interested in the matter. In the first place cotton, as a field crop in the plains of Bengal, is practically, at the present time, not in existence. It may therefore be regarded as a new crop whose cultivation it may be desirable to introduce. In these circumstances the first point to settle is whether the crop will grow, and the answer to this would be in the affirmative. The next point for consideration is as to whether there is room for it in the local rotation of crops, and if it would pay the cultivator better than the crops it would replace. Now cotton is a high land crop and, in Eastern and Northern Bengal, it would replace either aus paddy or jute. Aus paddy is, however, a food crop and has, in the opinion of many, already been replaced by jute to a greater extent than is economically safe. Moreover, jute is a much more valuable crop than cotton, and therefore it does not appear that there is any place for cotton as a field crop in Eastern or Northern Bengal. As a garden crop, room might be found for a few trees, but this, however worthy of encouragement, could not be expected to furnish more than a small portion of the annual cloth requirements of a family.

The case is rather different in parts of Western Bengal, and in the Burdwan Division in particular. On the high lands in this tract there is practically

no jute, and it would appear that there may be an opening for cotton here—a certain amount of it is indeed already being grown. As remarked above, the Agricultural Department has distributed cotton-seed on the same lines as other crops, and the cultivator in Western Bengal is thus provided with the opportunity of comparing cotton, on its merits, with other crops of the tract.

Demonstration and Agricultural Associations.—There is very little to add to the remarks under this head in last year's report. The demonstrations in connection with ground-nuts, bonemeal and green manuring in western Bengal are making progress, particularly in the Birbhum district, where the Collector, Mr. G. S. Dutt, I.C.S., is taking great interest in the work.

At the suggestion of Mr. Milligan, and through the efforts of Mr. Dutt, there is now in Birbhum a net-work of Agricultural Associations, which have been decentralised into Thana Associations, and in some cases, into even smaller societies comprising only three or four unions. At the request of Mr. Dutt, and of the Associations, a Departmental demonstrator has been appointed to each thana of the Birbhum district—16 in all—and the whole organisation is being watched with interest, as an experiment in co-operation, between the Agricultural Department and unofficial Associations, in the spread of improvements of various kinds, which the Department has to recommend. This development is particularly apt in Birbhum, where there are quite sufficient items of proved value to demonstrate, and a considerable increase in the use of bonemeal, green-manuring and the cultivation of ground-nuts may be looked for.

Somewhat similar developments are taking place on a smaller scale in Faridpur, which is regarded as an Eastern Bengal experiment. Genuine movements of this kind, if properly guided so as to engender the maximum of confidence in the Agricultural Department on the part of the Members of the Associations, represents the ideal of most officers of the Department. There are, however, many pitfalls, such as the unrestricted formation of societies with no definite object in view. It is hoped that this will be avoided by the presence of agricultural officers in every part of the district. It follows, of course, that it is absolutely essential that the Agricultural Department shall, as a result of the investigations done at head-quarters, by the Research staff, always have definite recommendations to make. As far as the future is concerned, this again involves a proper balance between the Research staff at head-quarters and the propaganda staff in the districts. The latter should never be developed out of proportion to the former.

Ufra Disease.

The scientific work with regard to this disease, though probably incomplete, has reached a stage at which definite conclusions have been arrived at. The latest report on the subject consists of a bulletin written by Dr. Butler, Imperial Mycologist, and issued by the Imperial Department of Agriculture. The more recent inquiries confirm the general recommendations made some time ago with regard to this pest, viz., the burning of the stubble of the previous crop, and dealing with the lower-lying areas which remain wet throughout the year. As is well known, a certain amount of stubble-burning is done in the *Ufra*-infected areas, and this, no doubt, tends to reduce infection. The more completely the stubble-burning is carried out the better, but stubble-burning is no protection to the individual, unless it is also done by his neighbours. The inducement for the individual to burn his stubble as a protective measure is thus small. It is very doubtful, moreover, whether propaganda will ever induce every member of the community, in the affected area, to burn his stubble and destroy other sources of infection. Under local village self-government, however, the enforcement of certain necessary precautions on recalcitrant individuals might become feasible. There are, of course, other questions with reference to *Ufra*, and it is open to doubt whether, even if *ufra* is suppressed by sanitary precautions, some other disease of an even more serious character may not crop up. The evils and dangers arising out of the present deep-water aman cultivation have been referred to in previous reports. The crop is grown under swamp conditions and in the

event of trouble, nothing can be done during the time of growth. Up to date no alternative crop has been found, which could be adopted on a large scale without irrigation. Until the question of the cultivation of the low-lying areas has been thoroughly investigated, little can be done in the way of suggesting improvements.

General.

The past year may be said to have been one of all-round progress for the Agricultural Department. The organisation of the district staff has developed, and it now includes three Deputy Directors, a Superintendent for each administrative division and a District Agricultural Officer for each district. Below the District Agricultural Officers there are 79 demonstrators. During the year the first three District Farms have been built and laid out, at Mymensingh, Bogra and Comilla, respectively. This is in accordance with the policy of Government, which includes the establishment, at the rate of three a year, of a Departmental Farm in each district. These farms will be in charge of the District Agricultural Officer, and will include a seed-store. The want of such farms has been felt for some time and, apart from their being district centres of agricultural activity for the public, as they undoubtedly will become, they will be of the greatest use to the Department for testing new varieties of crops, manures, etc., and for storing the seed requirements of the district. Sites for other farms have already been selected at Suri, Pabna and Bakarganj, and work will be commenced at these places in the present year.

An encouraging feature in regard to the District Farms is the local enthusiasm which is being displayed. At Murshidabad, for instance, the Hon'ble the Maharaja of Cossimbazar has offered a site, and also the expenses of running the farm for a certain period; at Pabna the District Board has done the same; the Bakarganj District Board have subscribed Rs. 5,000 and Sir Daniel Hamilton has undertaken to establish, and pay all the expenses of, a farm at Gosaba, 24 Parganas—the only condition being that the Agricultural Department shall supply the Superintendent and control the policy of the farm. Earlier examples of this kind of public spirit are the Burdwan Farm, established over 20 years ago by the late Maharajadhiraj of Burdwan, under similar conditions to those laid down by Sir Daniel Hamilton; the Rangpur Demonstration Farm by the Rangpur District Agricultural Association; and the Kalimpong Farm established by Dr. Graham.

The Agricultural Associations (*vide* page 9) are, of course, only another aspect of the interest which the public is beginning to take in the activities of the Agricultural Department.

At head-quarters the Research work proceeds apace in the laboratories, and on the experimental plots at the Dacca Farm. In the Botanical Section several hundreds of varieties of rice are under close study, and comparison with those which have already been accepted for distribution to the cultivator. Some of the races, at present under observation, represent an attempt to combine the good qualities of two kinds of rice in one plant by hybridisation.

The same is taking place with jute in the Fibre Section.

In the Chemical Department the study of the soils of the Province has continued throughout the year, and valuable knowledge is accruing regarding the nutrition of the crops which are grown in the Province.

The results obtained in all the sections are put into the form of practical recommendations as soon as they are available, and are at once, or will be eventually, used by the cultivator to better his economic condition. That this is no dream of the future is proved by facts in regard to the present year. The departmentally selected rice and jute at present occupy roughly 250,000 acres and 100,000 acres, respectively. Taking the average increased yields of the improved paddy and jute, over local races which they have replaced, to be 3 maunds (240 lbs.) and 2 maunds (160 lbs.) per acre, respectively, we arrive at the conclusion that, in the present year, the Bengal cultivator will, in the aggregate, be better off, on this account alone, by about Rs. 40 lakhs (£250,000 sterling). This figure may be expected to increase rapidly, for practically the whole rice and jute crops of the Province will probably be affected in quite a few years. In this case the net income of the cultivators

of rice and jute in Bengal would be increased by as much as Rs. 12 crores, (£7,500,000 sterling) per annum.

Similar work of a chemical nature has proved that the cultivator on the red soil tracts of Dacca and Mymensingh can, by suitable manurial treatment, practically double his net income.

The above are some of the results of the work at the Dacca Laboratories and it cannot be too widely understood that they could not have been achieved in any other way than through the patient research on which they are based.

It would be possible to multiply instances as well as to anticipate the future, but enough has been said to show the great importance of methodical investigation, followed by intelligent application of the results obtained. India above all countries affords scope for such a policy.

SECTION II.—SERICULTURE AND WEAVING.

General.—The work was continued on the lines of the previous years. Mr. A. C. Ghosh, Superintendent of Sericulture, Bengal, remained in charge of seed production while Mr. P. C. Chaudhuri carried on the work of cross-breeding at Berhampore. The feature of the year's work with regard to seed production, was an increase of 31 per cent. in the amount of "examined" seed sold to the people, following on the development of the central nurseries. Owing to improvements in the production of the nurseries, combined with a favourable monsoon, the amount of seed produced during the first 6 months almost equalled that of the whole previous year. The sericultural budget was so depleted in the production of this increased amount of seed that an extra sum of Rs. 25,000 had to be granted in order to utilise the resources of the nurseries during the remaining 6 months. This amount has been, however, fully recouped in sales. The amount of seed issued in 1918-19 amounted to 15,537 kahons (1 kahon=1,280) as against 11,102 kahons during the period from 1st April 1917 to 31st March 1918 and the total receipts amounted to Rs. 62,358 against Rs. 44,964 in the previous year.

In this connection two points call for remarks, viz., (*1*) that the increased expenditure was fully recouped by the increase in revenue, and (*2*) although the amount of seed available for distribution to the people was 31 per cent. greater than that of the previous year it was all disposed of at high prices. It would thus appear that (*a*) after the necessary expenditure has been incurred for supervision, repairs to buildings, etc., the outturn of the examined seed can at present prices be increased without loss; (*b*) that there is a much larger demand for nursery seed than most people expected. This, in itself, is an acknowledgment on the part of the buyers of the superiority of the Government seed. As a matter of fact, there probably exists a very much larger market than we have yet supplied, and it should be possible to further increase the outturn of seed from the nursery.

During the winter months a census of mulberry grown in the more important silk districts was undertaken with the assistance of the local authorities. The figures show that the area has increased from 18,188 acres at the time of the last census in 1913-14 to 24,335 acres this year, showing that the industry is capable of revival in times of high prices, especially where there is no serious competition from a more valuable crop. On the other hand, the figures for the Rajshahi district show a further decline from 332 to 150 acres in the same interval. In Rajshahi the competing crop is jute and it is still doubtful whether, at the present prices obtainable for the latter fibre, mulberry-growing is economical. There has been a slight tendency to an increase in the mulberry area of this district during the past year, but the movement cannot be said to be very strong.

Nine boys passed from the Rajshahi Sericultural School and five from the Sericultural Class at Berhampore.

Cross-breeding Experiments.—As stated above, the Berhampore Central Nursery has been temporarily set aside for the production of cross-breeding races on a large scale. It will be noticed from the appendices to

Mr. Chaudhuri's report, that the observations on different races have been carried out very exhaustively and that many points which hitherto received but little attention have been subjected to enquiry. The usual method of comparing races of silk-worms, according to the number of cocoons required to make a seer of silk, apply only to races of approximately equal size. The true comparison between the two races is their respective ability to make the economic use of their food, and a comparison on this basis has been attempted at Berhampore. The results so far received show clearly the superiority of some of M. Grangeon's hybrids. It still remains to be seen, however, how these races behave at the hands of the rearer who, judged by our accepted standards, systematically starves his silk-worm and rears them under conditions to which they are not subjected in the nurseries. Until, therefore, their hardiness and immunity to disease under local conditions of rearing is established, it would be a dangerous policy to distribute new races widely to the public.

Other Scientific Work.—Miss Cleghorn's work on hybridisation has been continued. Her report is appended. Mr. Hutchison's methods of detecting pebrine have been adopted at one of the nurseries as there is still some controversy as to the possibility of examining the large number of moths which have to be dealt with by the improved method.

Weaving.—Mr. N. N. Pillai, the Weaving Expert, spent 312 days on tour and during the year visited practically all the weaving centres of the Presidency. His services have been in much requisition regarding hand-spinning of cotton. Numerous unofficial attempts to revive this industry were made during the period when the price of cotton cloth was abnormally high.

SECTION III.—MISCELLANEOUS.

Arboriculture.—Progress reports of district arboricultural work for 1918-19 received from the local officers indicate that the highest expenditure on arboriculture was incurred in the districts of Mymensingh, Midnapore, Nadia and Jessore.

The class for the training of overseers and sub-overseers in arboriculture was held at the Royal Botanic Garden, Sibpur, from the 13th August to 12th September 1918, and seven officers attended the course.

Statistical Work.—The usual crop forecasts and statistical returns were published. In view of the present importance of food-stuff statistics, a special effort was made to improve the winter rice forecast by increasing the number of actual crop weighments. Some thousands of crop weighments were made and the data collected formed a very useful check on the returns sent in through the ordinary channels.

Arrangements have been made, through the Public Works Department, to supply weekly information regarding river-levels during the jute season.

Rainfall Stations.—Fourteen new recording stations were opened in the year, making a total of 244 in the Presidency against 230 in the previous year.

Financial.—The receipts and expenditure of the Department in connection with the Agricultural and Sericultural Stations will be found in the respective reports. The expenditure on miscellaneous experiments and enquiries, other than those carried out in agricultural stations and for sericultural work, during the financial year 1918-19, amounted to Rs. 5,12,000 as detailed below :—

	Rs.
Superintendence	74,000
Expert staff	1,55,000
Agricultural experiments	2,56,000
Seed stores	22,000
Cattle fairs and shows	1,000
Special crops	4,000
Total ...	5,12,000

Acknowledgments.—The thanks of the Department are due to a large number of Government officers, as well as private individuals, who have assisted the Department during the year with work in the districts. Several gentlemen have provided buildings to be used as quarters for demonstrators and for storing departmental seed. The Calcutta jute firms continue to help the Department by demonstrations at their mufassal agencies, and at their own expense, of the superiority of the Departmental jute seed. The Agency Managers, moreover, give considerable help in disposing of the seed among neighbouring cultivators, and generally show a sympathetic interest, for which the Department is very grateful. Thanks are also due to the staff of the Pusa Research Institute for very valuable help in connection with the production and sterilization of jute seed, investigations into the diseases of jute and of silk-worms and also for advice in regard to insect-pests.

Staff.—With the expansion of the Department and the continued absence of a large proportion of the superior staff, the burden falling on the remaining officers has been very heavy. The Department is indebted to Mr. Hector and Babu Rajeswar Das Gupta, on whose shoulders the extra work has largely fallen. The latter officer was in charge of two circles throughout the year. In the Provincial Service the work of Mr. J. N. Chakravarty in the Rajshahi Division, Mr. J. N. Sirkar in the Burdwan Division and Babu Jamini Kumar Biswas in the Dacca Division deserves mention.

The Laboratory Assistant staff at Dacca continue to render loyal and valuable services to the Department, and Babu Nirmal Chandra Basu, M.SC., Babu Gosta Behari Pal, M.SC., and Mr. S. G. Sarangpani, L. AG:, the senior Assistants in the Scientific Sections, have all done good work.

The work of the district staff as a whole is to be commended, but the District Agricultural Officers of Bankura, Birbhum and Mymensingh deserve special mention.

Mr. A. C. Ghosh, Superintendent of Sericulture, deserves credit for the remarkable improvement in the outturn of inspected seed, resulting in a corresponding increase of revenue from the nurseries during the year under review.

Mr. N. N. Pillai, Weaving Expert, has had a busy year, owing to the increased interest in home-spinning and weaving of cotton. He has shown energy in the performance of his duties.

ANNUAL REPORT OF THE FIBRE EXPERT TO THE GOVERNMENT OF BENGAL FOR THE YEAR 1918-19.

Charge.

I held charge of the Fibre Expert's and Agricultural Chemist's Sections throughout the year under review.

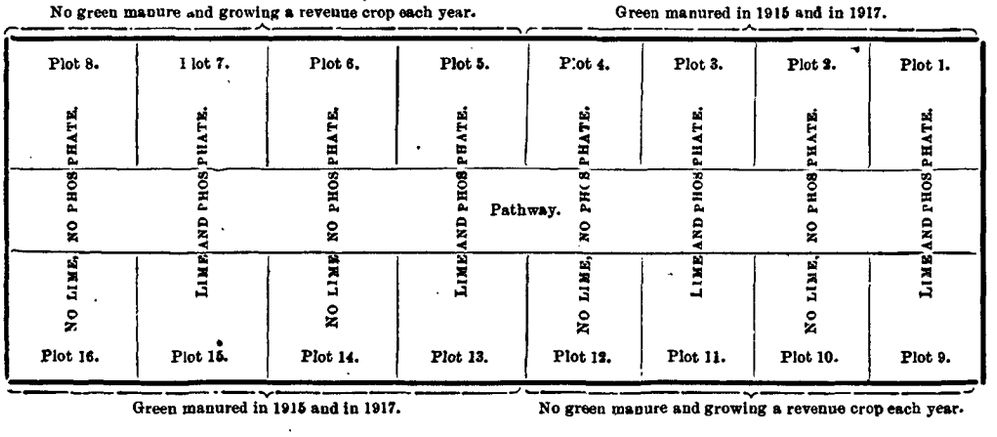
Tours.

Date.	Number of days.	Place.
1st to 3rd April 1918 ...	3	Benipore and Clacutta.
16th to 19th June 1918 ...	4	Calcutta.
7th to 10th August 1918 ...	4	Calcutta, Siliguri, Haldibari, Domar, Durwani and Rangpur.
25th to 28th August 1918 ...	4	
1st to 6th September 1918 ...	6	Chinsura and Rajshahi.
15th to 21st September 1918 ...	7	Rangiya and Calcutta.
22nd September to 5th October 1918	14	Calcutta, Pusa, Daulatpore, Dalsinghserai, Dooriah, Bowarrah, etc.
8th to 14th October 1918 ...	7	Rangiya and Siliguri.
31st October to 2nd November 1918	3	Siliguri and Saidpur.
6th December 1918 ...	1	Chashara.
17th December 1918 ...	1	Do.
19th to 24th December 1918 ...	6	Chashara and Calcutta.
1st to 7th January 1919 ...	7	Calcutta and Bankura.
17th January 1919 ...	1	Chashara.
22nd to 26th January 1919 ...	5	Calcutta.
6th to 12th February 1919 ...	7	Suri.
Total ...	80	

Manures for Jute on Acid Red Soils.

Central Mirpur Field Experiments.—As indicated in previous reports, this investigation has been proceeding, in collaboration with the Deputy Director of Agriculture, since 1915.

For the sake of convenience, the plan included in last year's report is reproduced below :—



N. B.—(*a*) Diagonally opposite quarters of the series receive identical treatment, *i.e.*, green manure or no green manure as the case may be.

(*b*) Alternate strips receive lime and bone as shown in the plan.

(*c*) In 1918 the whole area received hyacinth ash equal to 100 lbs. potash (K_2O) per acre.

Up to and including 1917 Rs. 40 worth of special manures, including bone and lime, had been applied to alternate strips of the series and the aggregate increased yields on the plots so manured amounted, in the three years 1915—17 inclusive, to approximately 15 maunds per acre of jute and 10 maunds per acre of rice. At Rs. 6 per maund for jute and Rs. 2 per maund for rice, the total increased value of the produce is Rs. 110 (£7-6-8). while the total cost of the lime and bone was less than Rs. 40 (£2-13-4). Thus, in three years, and with prices of both jute and paddy lower than usual, the aggregate increased net profit amounts to Rs. 70 (£4-13-4 sterling) per acre or an annual net profit of Rs. 23 (£1-10-8 sterling) per acre.

In 1918 the whole of the Central Mirpur plots received a general manure, including cow-dung and castor-cake, equivalent to 50 lbs. nitrogen per acre ; and as they were to be sown with jute, water hyacinth ash equivalent to 100 lbs. potash (K_2O) per acre was applied. In addition, the lime plots received a further dressing of 10 maunds (800 lbs.) per acre of slaked lime, making a total application of 40 maunds (3,200 lbs.) of lime since the commencement of this series in 1915, four years ago. Jute (C. Olitorius, R.26) was sown on the 23rd April 1918 ; the crop on the limed plots made great progress and at harvest time, it was, on the average of 8 plots of each kind, nearly four times as great as that on the unlimed plots. Details regarding the yields of monsoon crops in all four years of the experiment will be found in the following table :—

Treatment.	Plot No.	1915.			1916.			1917.			1918.		
		Crop grown.	Yield per acre.	Gross value per acre.	Crop grown.	Yield per acre.	Gross value per acre.	Crop grown.	Yield per acre.	Gross value per acre.	Crop grown.	Yield per acre.	Gross value per acre.
			Mds. Sr.	Rs.		Mds. Sr.	Rs.		Mds. Sr.	Rs. A.		Mds. Sr.	Rs.
Lime and Bone in 1915 and 1918.	1	Green Manure.	...	...	Jute.	19 23	117	Green manure.	...	...	Jute.	23 23	350
Green Manure in 1915 and 1917.	3		...	...		16 23	99		...	...		23 36	327
General Manure (40 lbs. Nitrogen) in 1916 and 1918.	13		...	...		16 2	96		...	...		24 24	337
100 lbs. K_2O per acre as Hyacinth Ash in 1918.	15		...	...		13 32	83		...	...		23 28	325
Means	...		...	...		16 20	99		...	...		24 15	334
No Lime and Bone	2	Green Manure.	...	...	Jute.	12 39	78	Green manure.	...	...	Jute.	7 8	69
Green Manure in 1915 and 1917.	4		...	...		12 24	75		...	...		7 20	72
General Manure (40 lbs. Nitrogen) in 1916 and 1918	14		...	...		8 37	51		...	...		7 29	74
100 lbs. K_2O per acre as Hyacinth Ash in 1918.	16		...	...		8 34	50		...	...		7 14	70
Means	...		...	...		10 34	65		...	...		7 18	71
Lime and Bone in 1915 and 1918.	5	Jute.	19 4	114	Jute.	12 15	75	Aus Rice.	14 19	32 9	Jute.	22 36	322
No Green Manure	7		6 35	40		8 7	49		14 22	32 12		23 10	313
General Manure (40 lbs. Nitrogen) in 1915, 1916 and 1918.	9		22 24	135		12 33	77		21 36	49 5		22 20	303
100 lbs. K_2O per acre as Hyacinth Ash in 1918.	11		17 14	104		6 12	28		16 32	37 12		22 20	303
Means	...		16 19	99		9 37	60		16 37	38 0		23 2	310
No Lime and Bone	6	Jute.	1 2	6	Jute.	0 21	3	Aus Rice.	2 37	18 0	Jute.	0 30	7
No Green Manure	8		1 7	7		0 24	3		5 25	33 0		2 28	27
Green Manure (40 lbs. Nitrogen) in 1915, 1916 and 1918.	10		13 7	79		4 32	28		9 24	57 0		11 4	109
100 lbs. K_2O per acre as Hyacinth Ash in 1918.	12		13 17	81		2 29	16		9 21	57 0		8 10	81
Means	...		7 8	45		2 6	12		6 37	15 9		5 28	56

Thus, in the four years the limed and the no lime plots have respectively given aggregate yields as follows :—

Crop.	Lime and Bone. Mds. Srs.	Value. Rs.	No Lime or Bone. Mds. Srs.	Value. Rs.	Difference. Rs.
Jute	49 18	462	15 2	113	...
Aus Rice ...	16 37	38	6 37	16	...
Total Revenue ...		500		129	371
Total cost of Special Manures applied in four years ...		70		18	
Therefore, Net Total Revenue per acre in four years ...		430		111	319
Therefore, Average net Revenue per acre per annum ...		107		28	79

In other words the money expended on lime, bone and potash manures on the Central Mirpur plots at Dacca has practically trebled the net revenue per acre and in doing so has yielded interest at approximately 100 per cent. per annum.

The results are extremely interesting, as they finally prove that, for jute, lime and potash are both limiting factors at Dacca and that a normal crop of jute cannot be grown on the red soil without the application of manures containing both of them.

The results also serve incidentally to point out the value of the hyacinth ash as a potash manure. Hyacinth ash was used as the source of potash in these experiments, as well as for ordinary manurial purposes on the farm.

Experiments to determine the most efficient dose of potash for the red soil tracts indicate about 100 lbs. K_2O per acre for jute, equivalent to 1,000 lbs. of hyacinth ash containing 10 per cent. of potash, as a satisfactory amount to apply.

The green-manured plots in the Central Mirpur series do not show a sufficient margin over the non-green-manured area to compensate for the loss of two crops. This is quite in agreement with general experience at Dacca, where the results are entirely against monsoon green-manuring. During several years a search has been made for a suitable catch crop green manure, which could be sown after the reaping of the most important high-land crop of the year, viz., the *kharif* crop, and ploughed in before the land hardens in the dry weather. If such a procedure would produce a serious increase in the following jute crop the loss of a *rabi* crop would be a small matter in comparison. A wild *Crotolaria* has been found which seems to offer considerable promise, and sufficient seed of it has now been obtained to make a trial in the coming year.

Seed Jute.

(*a*) *Corchorus Capsularis.*—In the last season roughly 1,500 maunds (55 tons) of the seed of Kakya Bombai were raised. About one-third of this was grown in Assam by Messrs. Birkmyre Brothers and the remainder was produced by Bihar planters.

There is a very great demand for the seed—much greater than the supply. In consequence of this it has been decided to still further raise the price to Rs. 15 per maund to consumers, in order to be able to offer a better price to producers and thus increase the supply. It is hoped that the inducement of higher prices will cause a considerably greater area of seed jute to be put down in Bihar in the coming season.

Partly as result of the precautions taken to sow the seed jute as late as possible the attack of *diplodia corchori* was not so generally serious last season (1918) as in the previous year. Nevertheless, early sown crops at Pusa and elsewhere suffered considerably. The Assam crop was, as far as could be ascertained by inspection, free.

In collaboration with the first and second Imperial Mycologists an investigation is being made into the liability of early sown jute to attack by *diplodia*.

As was the case last year the whole of the Bihar-grown seed was collected and disinfected at Pusa before its dispatch to Bengal. The entire work of disinfection was undertaken by the first and second Imperial Mycologists and their respective staffs, and we are very much indebted to them for the trouble they went to in the matter.

As a result of the application of the Director of Agriculture's system of distribution of small packets of seed, there is now a considerable area of Kakya Bombai jute in Eastern Bengal and the coming season will probably see a minimum of 100,000 acres devoted to it.

(*b*) *Corchorus Olitorius.*—Besides the 1,500 maunds of Kakya Bombai seed already referred to, about 150 maunds (or 6 tons) of the seed of the new pure line of Corchorus Olitorius (R.26) were produced, chiefly in Bihar, in 1918. The bulk of this latter seed will be disposed of in the Rajshahi, Presidency and Burdwan Divisions. It is hoped to raise a similar quantity of it in the coming season.

Single Plant Cultures.

In the season 1918 there were about 400 single plant cultures of jute at Dacca, some of which gave great promise. Retention or rejection of the cultures for further trial was again partly based on the capacity of the leaves of the plants to resist *chlorosis* and it was almost invariably found that *non-chlorotic* strains are more vigorous, and grow taller, than strains subject to *chlorosis*. The *non-chlorotic* cultures were only noticed in 1917, an extraordinarily bad season at Dacca, when the attention of both the Director of Agriculture and the writer was drawn to them as being the only ones which approximated to a normal growth. One *non-chlorotic* selection (R.85), a strain of Kakya Bombai, had been made two years before, in a crop at Rajshahi; but we were not aware of its *non-chlorotic* properties at the time. In variety tests in 1918, it was a much better crop than other strains of Kakya Bombai, all of which were *chlorotic*, and, in the end, yielded two and-a-half maunds more fibre per acre than the latter.

We have already about 20 maunds of the seed of R.85, and it will be multiplied on as large a scale as possible in the coming season, at the close of which it is hoped we may have nearly 1,000 maunds (35 tons).

Some of the pure lines in 1918 were fixed hybrids and two or three of them have been kept for further trial on a large scale. Of the original parents of these hybrids, one of each was a plant whose fibre appeared, from chemical and miscroscopical tests, to be rather better than the average. The other parent in each case was a heavy yielder, the object being, if possible, to combine the highest degrees of yielding power and quality in the same plant. All the cultures kept are *non-chlorotic* ones. The original crosses were, in some cases, made as far back as 1910.

Single plant selections made during the season 1916 have been multiplied sufficiently to enter variety tests in the coming season. One or two of them give promise to rival, if not to beat, Kakya Bombai. Hitherto, none has done so, excepting the *non-chlorotic* strain of Kakya Bombai, R.85, already referred to.

Jute Experiments at Other Places than Dacca.

Rajshahi.—The variety tests of Carohorus Olitorius were continued in 1918 with six pure lines, of which three, viz., R.26, R.27 and R.30, were in the previous year's (1917) series and three, viz., "Chinsura Green", R.29 and R.62, were new.

The tests were not so satisfactory as in the previous years, because the crop was not nearly so well grown, as the yields show. However, they seemed conclusive in regard to the inferiority of R.29 and R.62; but R.30, R.26 and "Chinsura Green" must be again tried. If the 1918 tests at Rajshahi are to be relied on, while R.30 and R.26, both high yielders, are about equal, "Chinsura Green" is considerably better than either.

Chinsura.—As at Rajshahi "Chinsura Green" was easily first among the five varieties compared, viz., R.26, R.27, R.29, R.30 and "Chinsurah Green". R.30 appeared to be rather better than R.26 and must be tried again. R.29 was nearer R.26 than at Rajshahi, but not equal to it. R.27 was markedly inferior to R.26 and both it and R.29 have been neglected.

Rangpur.—The variety test with pure lines of Corchorus Olitorius was practically a failure owing to bad weather. R.62 and to a less extent "Chinsura Green" stood out above the others.

In the coming season R.26, R.30, R.62 and Chinsura Green will be finally compared at Rajshahi, Chinsura and at Rangpur.

Experiments at Mufussal Agencies of Calcutta Jute Firms.

In the year under review there was a comparative lull in this work. The previous two years had decided the superiority of Kakya Bombai as regards its yielding power, which was the chief object with which the tests had been commenced.

In view of the increasing popularity of the fibre of Corchorus Olitorius, Mr. Suttie suggested that comparisons should now be made, at Messrs. Sinclair, Murray's agencies in Eastern and Northern Bengal, between the respective yielding powers of Corchorus Capsularis and Corchorus Olitorius. This was accordingly done, but owing to the bad season, little information was gained beyond the knowledge that, excepting on very high land, Corchorus Olitorius is more likely to suffer from excessive rain than Corchorus Capsularis. This is practically the sum of the results—the yields were nearly all poor and it was once again demonstrated how great a factor the weather is in the success, or otherwise, of field experiments.

At Godenail, Naraingunge, Mr. John Luke had two experiments. On the lower field he tested the respective effects of lime and hyacinth ash on jute and on a higher plot he compared the yields of the two races of Corchorus Olitorius, "Chinsura Green" and R.26, which have already been referred to. As at Rajshahi and Chinsura, "Chinsura Green" proved itself considerably the heavier yielder, the mean returns from duplicate plots being as follows :—

Dacca Green	...	...	...	30	maunds per acre.
R.26	...	...	...	18¾	„ „

On the lower field the results indicated that the effect of the addition of lime on the silt soils is to reduce the yield, in the first year at any rate. This point will be followed up.

In the coming season (1919) an important series of experiments is to be carried out, at Messrs. Sinclair, Murray's agencies, to decide how far the nature of the fibre of jute plant can be affected by details of cultivation, such as the amount of thinning which the crop undergoes. The practice of thinning varies from district to district; for instance, in one tract the plants are only thinned out to a distance of from 4 to 5 inches apart, whereas in another the thinning is done to 8 to 9 inches. In the latter case the plants are naturally considerably more robust, *e.g.*, taller and thicker, than in the former, and it is only to be supposed that this will be reflected in fineness, or comparative coarseness, of the fibre obtained. The point is one regarding which it is important that we should be in possession of definite information.

At Messrs. Landale and Clark's agencies, it is proposed to commence an investigation into the effect of environment on the quality of jute fibre. For this purpose jute seed from each of several tracts, known to the trade as producing characteristic fibre, will be sown side by side at the several agencies. The object is not so much quantitative, as to compare the quality of the respective fibres produced from the different kinds of seed, under the different conditions of each agency. Messrs. Sinclair, Murray's and Messrs. Landale and Clark's experiments, if successful, will yield results of great value, both to the Agricultural Department and to the jute trade in general, and the various agencies have undoubtedly an opportunity of doing a second good piece of work by carefully carrying out the proposed trials.

Owing to pressure of other work I was unable to visit all the agencies in the season 1918, but I saw the Godenail plots at Naraingunge where Mr. Luke secured useful results and also those at Siliguri, Haldibari, Domar and Durwani in Northern Bengal, of which Mr. E. A. Thomas is in charge.

Water Hyacinth.

In last years' report it was mentioned that preliminary experiments had been made in the extraction of pure chloride of potash from hyacinth ash. After several trials it was found that, by allowing water to percolate through two or three perforated kerosine tins containing ash, a strong, or saturated, solution of the salt is obtained. It was also found that the dry plant, in burning, evolves ample heat to perform the evaporation of the salt solution to crystallizing point and, further, that there is no difficulty in obtaining a crystalline product of which approximately 90 per cent. may be chloride of potash and 5 per cent. sulphate of potash. Of other salts, the slightly soluble sulphate of calcium comes out of solution, as a scum, early in the evaporation; on the other hand, salts of magnesium are much more soluble than potash salts and remain in solution when the potash salts crystallize out.

An experimental plant was first set up at Dacca, where about a ton of the pure salt was prepared and forwarded to Messrs. Shaw, Wallace & Co. Later, in the cold weather, the installation was transferred to Naraingunge, where it has been working more or less continuously for two months. The amount of hyacinth plant available locally was not sufficient to keep the installation going, so the local hyacinth was reserved as a source of heat, and ash was bought in the district for extraction. The quality of the ash has been very poor, which impeded the successful working of the installation to some extent. Nevertheless, with 10 per cent. ash there has been no difficulty in producing from 2 to 2½ maunds (160 to 200 lbs.) of pure salt per day. With really good ash of 15 per cent. (K_2O) content, or over, the output would have been nearer 4 maunds (250 lbs.) of salt per day. Altogether about 4 tons of salt will have been made at Naraingunge, worth about Rs. 1,400, and the total value of salt produced in the dry season 1918-19 will probably exceed Rs. 2,000.

An apparatus like that at Naraingunge was also installed at Sonaimuri (Noakhali), where about 70 maunds (2½ tons) of salt were prepared.

The total amount spent on the extraction will be considerably more than the receipts, chiefly because the handling of the fresh plant with hired labour has been found so expensive. Our expenses are however probably heavier than those of private people would be, and it remains to be seen if the salt extraction will be taken up. The greater part of the operation is perfectly familiar to any one who has boiled sugar, as is the case with so many cultivators; moreover, the extraction can be done as well with earthen *gumlahs* as with kerosine tins; and the taste of the filtrate, salt or otherwise, is as good a test as any other to decide when the extraction of the ash is complete. Further, as the dry plant is an efficient fuel it would seem that the hyacinth contains the possibility of a home industry, which could be worked in the cold weather when agricultural operations are more or less at a standstill.

Of course, the production of ash, or of salt, for sale is only advisable in the silt areas where the soils are rich in potash. It has already been shown in this report how essential potash is to a successful jute crop on the red soils and, in the latter tract, the department is advising cultivators to collect and burn the hyacinth plant and to apply the ash as a manure. We are informed that this advice is already to some extent being followed.

Sann Hemp.

The attempts to utilize sann hemp for the manufacture of canvas referred to in last year's report have made progress and those qualified to judge consider that there is no little doubt of the ultimate success of this work. The far-reaching importance of such a result has already been referred to.

Shoe-makers, saddlers and upholsterers have felt the shortage of flax for use as thread, equally with those who required canvas, and attempts to manufacture suitable thread from sann hemp have been made. Little success, however, has so far attended these efforts. Possibly this is owing to lack of proper machinery—for flax thread produced in India under similar conditions, is not nearly so good as the English-made flax thread. The experiments are proceeding.

With the aid of a grant from the Government of India some work in the direction of improving the method of extraction of sann hemp is being done, but it is too early yet to speak of results.

Sida.

In the last year sida has again given encouraging results as a field crop at Dacca. Sown in the latter half of May on land not directly manured it yielded an average of about 15 maunds per acre of excellent fibre. In view of the practically unanimous opinion that the demand for fibres of the jute class will increase considerably in the near future, sida may in the course of time come to play a part of considerable importance. Its great advantage over jute, for tracts outside the climatic conditions of Bengal, is that it can be sown on high land at the beginning of the monsoon, and still yield a good crop of fibre. Under such conditions jute would certainly be a failure.

We again express our indebtedness to the Calcutta jute firms and their local agents who have helped us in carrying out field experiments in the mufassal.

Mr. N. C. Bose, M.SC., Chemical Assistant, Babu Tara Nath Roy, Field Assistant, and the other members of my staff have all done excellent work in strenuous year.

ROBERT S. FINLOW,

Fibre Expert to the Government of Bengal.

ANNUAL REPORT OF THE AGRICULTURAL CHEMIST TO THE GOVERNMENT OF BENGAL FOR THE YEAR 1918-19.

Charge.

I have held charge of the office of the Agricultural Chemist during the whole of the year under review.

Staff.

Babu Indu Bhusan Chatterjee, 2nd Assistant, is still in Bihar; Babu Kumud Behari Sen, who was appointed in Indu Babu's place, has accepted a post with Messrs. Bird & Co., Calcutta, and his place is therefore vacant at present. Mr. S. N. Bose, Bacteriological Assistant, took 2 months and 18 days' leave on account of illness. Mr. G. B. Pal, 1st Assistant, also took 1 month's privilege leave. Babu Atul Chandra Bose, B.SC., officiated in place of Mr. S. N. Bose.

Tours.

My own tours are included in the report of the Fibre Expert. Of the other officers in this section Mr. G. B. Pal, 1st Assistant, and Mr. S. N. Bose, Bacteriological Assistant, proceeded to Pusa at the end of February, to attend the sectional meeting there of chemists and bacteriologists.

Provincial Soil Survey.

This work is proceeding on the lines indicated in last year's report. The analytical data obtained generally resemble those already quoted; they therefore call for no special remark, excepting that they are supported by the results of field tests.

Analysis of the Ash of Plants.

A considerable amount of work has been done in this direction, partly as a complement to the soil survey, and partly with a view towards further elucidation of the apparent relation which exists between the state of nutrition of plants and their liability or otherwise to attack by fungus disease. The incidence of *rhizoctonia* in jute in the red soil tract, as a result of potash starvation, has already been mentioned; and the attack of other fungus diseases, such as the pigeon-pea wilt, appear to be associated directly with chemical conditions existing in the soil. So far little more information has been obtained which would lead towards more definite conclusions; but there are nevertheless interesting indications of such. The work is being continued in collaboration with the Imperial Mycologist and the 2nd Imperial Mycologist.

Sugarcane.

The work of comparing and selecting local and exotic varieties of cane, with respect to their suitability to Bengal conditions, was continued during the year under review. The careful examination of all setts, by the Mycological and the Entomological Assistants respectively, apparently had its result in a particularly healthy crop in 1918-19, as compared with the serious amount of disease which affected the cane in 1917-18.

Of 10 varieties selected for actual tests in regard to the amount of *gur* produced 9 (nine) were exotic, the tenth being Dacca *gandari*.

The crop made excellent progress in the early part of the season; but the very early cessation of the monsoon damaged it to such an extent that the yield was only about half the normal. By the beginning of November, the crop was dying for want of water, and would have done so if it had not been possible, by hiring an oil engine and pump from the Dacca District Board, to irrigate it. The conditions at the latter end of the season being so unfavourable, the yields can hardly be taken as indicating the respective merits of the different canes, which must therefore be subjected to another year's test. J.247, a Java cane sent for trial by Dr. Barber, was considerably the best yielder, with practically 60 maunds of *gur* per acre.

Of the local canes, a number proved to be very poor in all respects and were neglected. On the other hand, several varieties have very considerable merit, and one or two promise to compete with the best exotics. For instance, *hemza*, a medium thick russet cane; and *marikul*, a purple cane—both of tall and vigorous growth—gave juice containing 15·5 per cent. and 15·2 per cent., respectively, of sucrose. Unfortunately the multiplication of none of the local canes has proceeded sufficiently far to enable a *gur*-making test to be made, but it is hoped that this may take place in the coming season.

At Rajshahi, in a trial of seven varieties, Yellow Tanna was the highest yielder in a poor season.

Babus Gostabehari Pal, M.Sc., and Kumud Behari Sen, M.Sc., have done patient and conscientious work during the year. Apart from the laborious analyses inseparable from an undertaking like a soil survey, considerable difficulty was at one time experienced on account of impure reagents.

ROBERT S. FINLOW,

Offg. Agricultural Chemist to the Govt. of Bengal.

ANNUAL REPORT OF THE ECONOMIC BOTANIST TO THE GOVERNMENT OF BENGAL FOR THE YEAR 1918-19.

Charge and Establishment.—The Economic Botanist was in charge of the section throughout the year under review. During the year a second Assistant was sanctioned by Government and Babu Kali Prasanna Roy, who had for some time worked as a temporary Assistant, was appointed on probation to the post. A scheme for a further increase of staff was also submitted to Government.

Tours.—The Economic Botanist spent 79 days on tour during the year, as shown in the statement below:—

Lyallpur ...	To assist at Diploma Examination	April and May	25-4-1918 to 8-5-1918
Chinsura ...	Rice	July ...	2-7-1918 to 9-7-1918
Ditto ...	Do.	August ...	9-8-1918 to 12-8-1918
Mymensingh and Haldibari with the Imperial Mycologist ...	To examine jute disease and betel-nut disease ...	Do. ...	23-8-1918 to 26-8-1918
Kumarikhatta ...	To examine seed jute with the Fibre Expert	September ...	15-9-1918 to 22-9-1918
Chinsura ...	Rice.		
Berhampur, Hurseong, Chinsura ...	Mulberry disease and rice ...	October ...	12-10-1918 to 4-11-1918
Karimganj ...	Rice	November ...	23-11-1918 to 26-11-1918
Gafargaon and Joydebpur	Do.	December ...	11-12-1918 to 13-12-1918
Chittagong, Mirsarai, Chinsura and Memari	Do.	Ditto ...	14-12-1918 to 20-12-1918
Chinsura ...	Do.	February ...	1-2-1919 to 3-2-1919

Mr. S. G. Sharangapani, 1st Assistant to the Economic Botanist, was on tour for 69 days, of which period 59 days were spent on deputation in the Bombay Presidency in March and April 1918, examining local conditions of rice cultivation in that province. Babu Hemsanker Majumdar, temporary Assistant, was deputed to Chinsura in the middle of October 1918 to supervise rice work in progress there.

Rice.

Rice continues to occupy most of the time of the Botanical Section and the following items of work were in progress :—

(1) **Transplanted Winter Rice, Dacca.**—The collection of pure-line types was continued and extended. These are now being arranged and grown in order of their date of flowering—early ones on the highest situation and late ones on the lower. This arrangement is convenient from an economic point of view and makes the collection easier to handle, though it means an increased risk of types being contaminated by cross-fertilisation. It has now been amply confirmed that under the conditions in which our types are grown on the Dacca Farm, cross-fertilisation is taking place to an extent of about 2 per cent. per annum, an amount by no means negligible and necessitating careful rogueing of plots every season. In addition to *Indrasail* (Dacca No. 1) six other types have been selected for yield and are now under careful observation and one of them at least promises to equal if not excel *Indrasail*. The year past was characterised by heavy rain in the early part of the season causing flooding soon after transplanting, followed by drought in the end of the season. Consequently, many of our plots were damaged by flood at the start, while the late varieties, owing to late scarcity of rain, set lighter heads of grain than they ought to. Hence, this year's results were rather uneven. A convenient method of testing varieties has now been established by which the error is reduced to about 2·5 per cent., which is sufficient to establish with a good degree of certainty differences in yield of approximately 8 per cent. and upwards. The distribution of Dacca No. 1 continued and about 5,000 maunds were sent out during the year and distributed to over 25,000 cultivators. It is estimated that this coming season there will be about 100,000 acres under this variety in the districts of East Bengal.

The work of determining the inheritance of characters on crossing was continued and a number of fresh crosses made. Interference of factors has been indicated in at least two cases, viz., between colour in ligule and pulvinus and grain colour : and between colour in the leaf sheath and ripening colour of the glumes in a second case.

Chinsura.—A survey of the varieties grown in the Presidency and Burdwan Divisions has been started at Chinsura, chiefly with the object of selecting early varieties suitable for the western parts of Burdwan Division. Trials of *Indrasail* at Chinsurah and in the districts have tended to show that

while *Indrasail* is suitable for medium low-land, it is not so suitable for the higher types of land such as are found in Burdwan, especially in seasons of short rainfall, and a shorter duration paddy is wanted. The difficulty may be got over by growing varieties of *Aus* in such place as transplanted paddy. This was successfully done with *Kataktara* this year. Careful trials of *Indrasail* and *Nayra* (the best local paddy) were continued and resulted in an increased yield in favour of *Indrasail* of about 8 per cent.

(2) **Aus.**—The work on *Aus* (early) rice was continued and various fresh selections made. The variety known as *Kataktara* was distributed for the first time with very successful results. It has one drawback however. It is rather late for two-cropped land. Unfortunately, all the early varieties are poor yielders. So far we have not found an early type which is at the same time a high yielder. To see if this can be overcome a large series of crosses have been made between a common early variety of the neighbourhood known as *Pooki*, and several late high-yielding types, amongst which is *Kataktara* with the object of determining whether the high yield of the *Kataktara* type can be combined with the earliness of *Pooki*.

(3) **Deep-water Rice.**—A collection of deep-water *Amans* of Dacca Division was grown for the first time in a tank specially made for the purpose, and selections made from which to continue the work. A further area has also been made for growing low-land *Aus* varieties. Experience has shown that if such work is to be done successfully, arrangements must be made to keep the water flowing.

Other Work.

Cotton.—The question of cotton cultivation was brought to the notice of the Department early last year owing to the high price of cloth, and the Botanical Section was asked to make trials of varieties likely to succeed in the plains of Bengal, with a view to determining which could best be recommended.

Seed of the following were obtained from other parts of India :—

(1) Bihar, (2) Roseum, (3) Sindewahi, (4) Buri, (5) Cambodia, (6) Dharwar American.

These were sown in ridges, spaced 3 feet apart every way, on well-drained land, richly manured. The seed was obtained late and could not be sown before the middle of June, but this was probably an advantage than otherwise, for they thus escaped the very heavy rainfall which took place in the early part of the season. Moreover, the short rainfall in the end of the season was also all in their favour. Very little rain fell after mid-September and conditions for Bengal were almost ideal for cotton in the end of the season. The following yields of seed-cotton per 100 plants with the rate per acre were obtained :—

Variety.	Per 100 plants.	Per acre.
	lbs.	lbs.
Cambodia (C. P.)	2·3	160·5
K. 22	1·9	135·0
Dharwar	1·2	88·5
Cambodia (Bombay)	·90	63·0
Buri	·88	61·8
Bihar	·29	20·4
Roseum	·10	7·5
Sindewahi	·06	4·8

It will thus be seen that the only variety which did even moderately well was Cambodia (C. P. seed), and it yielded only at the rate of 160 lbs. of seed cotton per acre up to the end of February. K. 22 came second, but owed its place really to the small number of plants which survived. The next best varieties were Dharwar, Cambodia (Bombay seed) and Buri. The results are so poor that it is not possible to make any recommendation beyond the general statement that the only varieties at all possible are Cambodia, Dharwar and Buri. Late sowing proved a complete failure, and is obviously no use

without irrigation on the Dacca Farm. These results agree with the district results where Dharwar American proved practically a failure everywhere, said to be due to heavy rain at sowing season. The results confirm previous experiments with cotton in Lower Bengal.

Other crops.

The pure-line collections of *Matikalai* and *Mung* (Phaseolus mungo and radiatus) and chillies (Capsicum annuum) were kept up and further observations made regarding them. When the new farm at Mymensingh is ready it is proposed to transfer there all work on *rabi* crops, as it has been found almost impossible to carry on such work on the Dacca Farm soils.

Ufra.

An account of work done on *Ufra* is given in the Report of the Mycological Collector. Most of the areas under experiment were left to the respective owners to treat in their own way and were merely kept under observation. It has been decided to stop further work in stubble-burning departmentally and to confine attention to other lines of attack, such as converting low-lying areas into *boro* land, encouraging *rabi* cultivation, growing early varieties which may escape the disease, etc. The work is in the hands of the district staff.

Mycology and Entomology.

The Mycological Collector and the Entomological Collector continued to work under the Economic Botanist. Separate reports of their work are submitted.

G. P. HECTOR,

Economic Botanist to the Government of Bengal.

ANNUAL REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, EASTERN CIRCLE, FOR 1918-19.

I took over charge of the Eastern Circle from Babu Rajeswar Das Gupta on the 3rd February.

In submitting the reports of the Superintendents of Agriculture, Dacca and Chittagong Divisions, and the Dacca Farm, I beg to draw attention to the following points.

The extended cultivation of Indrasail (Dacca No. 1) paddy.—A low estimate puts the area in my circle under this variety at 75,000 acres and in 99 per cent. of the fields reported on substantial increases of yield have been obtained varying from 2 to 10 maunds per acre. Taking an average increase of 5 maunds the introduction of this variety has meant an enhanced income to the cultivators of this circle of about 10 lakhs of rupees.

It has proved unsuitable in the saline tracts of the Chittagong Division and an improved variety for those tracts will have to be evolved.

Kataktara aus paddy was tried extensively throughout the circle and proved almost without exception better than any local variety, the increase being from 2 to 12 maunds an acre, averaging 7 maunds per acre.

Kakya Bombai No. 7 Jute is now the most popular in the circle. 100,000 acres will be under this variety in the coming season. Unfortunately the demands for seed have been more than double the supply available,

1,500 maunds being issued. The fibre from this variety has been sold in many districts at a premium.

Potatoes.—The efforts to introduce potatoes as a cold weather crop in districts where previously they were not grown, have proved successful. In a number of districts the supply of seed potatoes is now in the hands of local merchants.

Tobacco.—Selected local tobaccos, Bhengi and Motihari, have been introduced and are replacing the local tobaccos in several districts.

Sugarcane.—The introduction of better canes was continued. The cultivation of Tanna extended considerably, particularly in Kaoraid, where it was introduced by Professor B. C. Gupta of the Sibpur College on his father's estate.

Cotton.—So far the experimental work in the districts has not shown any indication of cotton cultivation being successful. The low yield per acre does not induce the cultivator to replace jute by cotton.

Manures.—As will be seen from the Fibre Expert's report the value of the application of lime and bonemeal on the red laterite soils is established and it is intended to push the use of these manures on red soils.

Agricultural Farms and Seed Stores.—Two District Farms have been started at Mymensingh and Comilla and it is hoped they will be ready for cropping this coming season. Seed stores have been opened in five places, viz., Laksham, Munshiganj, Kaliganj, Joydebpur and Narasingdi.

The District Board of Barisal has come forward with proposals for the establishment of a District Farm there, offering to undertake a share of the financial cost.

In Faridpur there is also a strong local demand for a District Farm and the establishment of seed stores.

Throughout the circle there is a growing demand for the furtherance of agricultural work and a keen appreciation of its value.

Irrigation.—The introduction of the practice of irrigation of crops in the cold weather is a pressing need. It is hoped that experiments will be carried out during the next cold weather to establish this practice.

Acknowledgments.—My attention has been drawn to the valuable assistance afforded by the District Officers and by many influential gentlemen who helped to further agricultural improvements in the districts and on their own estates.

K. McLEAN,

Dy. Director of Agriculture, Eastern Circle.

ANNUAL REPORT OF THE SUPERINTENDENT OF AGRICULTURE, DACCA DIVISION, FOR 1918-19.

Staff.

The staff consisted of one Superintendent of Agriculture, four District Agricultural officers, and 35 fieldmen demonstrators (31 paid by Government and 4 paid by the Court of Wards' Estates). A further 6 temporary demonstrators were employed for a short period by the Court Wards' Estates, Bakarganj. Two additional Distrtct Agricultural officers were appointed from April 1918, one for Dacca and the other for Mymensingh, as in both districts the work was too heavy for one officer.

A temporary staff of 50 men was also entertained for jute and paddy seed distribution, Ufra survey work and jute forecast work. During the year I was in charge of the division. Babu Santi Prosad Sen, District Agricultural Officer, Dacca, has been transferred to the Dacca Farm and Babu Khitish Chandra Guha appointed in his place. The number of days on tour

and the principal places visited by the officers in the division are noted below :—

Name and designation of the officers.	Number of days spent on tour.	Name of important places visited.
Babu Jamini Kumar Biswas, Superintendent of Agriculture, Dacca Division.	255	Barisal, Calcutta, Manipur, Faridpur, Mymensingh, Tarpassa, Kisoreganj, Sarisabari, Gaffargaon, Kaliganj, Joydebpur, Kaoride, Godenail, Narayanganj, Goarnadi, Kurmitolla, Rangpur, Khulna, Taltolla, Sherajdigha, Munshiganj, Sripur, Tangi, Bhairab, Saidpur, Mirpur, Ati, Madaripur, Rajbari, Gopalganj, Kashipur, Jamalpur, Burirhat Farm, Mirkadim, Goalundo and Baburail
Babu Kshitish Chandra Guha, District Agricultural Officer, Dacca.	78	Munshiganj, Sripur, Kaliganj, Godenail, Narayanganj, Baiderbazar, Rupganj, Joydebpur, Narsingdi, Gatulla, Pabil, Tangi and Murmitalla.
Babu Utpal Chandra Sarkar, Additional District Agricultral Officer, Dacca.	180	Narayanganj, Manikganj, Munshiganj, Joydedpur, Tangi, Kurmitolla, Kaoride, Sripur, Pubail, Kaliganj, Ghorashal, Jinardi, Daulatkandi, Mangalband, Ganda, Mumarbhog, Chitracote and Godenail.
Babu Satindra Lal Sen Gupta, District Agricultural Officer, Mymensingh.	249	Jamalpur, Netrokana, Kesoreganj, Tangail, Durgapur, Halunaghat, Jharia, Mirzapur, Purbadhalla, Hosenpur, Bousi, Bhanbari, Mahirakul, Malancha, Gouripur, Iswarganj, Ramgopalpur, Bharirab, Goffergoan, Bakandia, Fulbaria, Trishal, Dhankhola, Atharabari, Bagunbari, Muktagacha, Charbasanti, Tarati, Sarisabari, Elashin, Piarpur, Dewanganj, Dharmakura, Sherpur, Nandina, Dhalla, Ramamritaganj, Daspunia, Islampur, Dagi and Gangtia.
Babu Debendra Kumar Mittra, District Agricultural Officer, Faridpur.	225	Bhanga, Talma, Sadarpur, Bhusbna, Kistopuri, Madhukali, Bilmamudpur Saldua, Goalundo, Rajbari, Habaspur, Baliakandi, Sonapur, Korakdi, Madaripur, Palong, Bhojeswar, Charmuga, Swarnaghose, Ketapara, Gopalganj, Madhupur, Kalaturi, Sanpukhuria, Kotaipara, Balait and Dacca.
Babu Surendra Nath Sen, District Agricultural Officer, Barisal.	184	Mahendiganj, Gaurnadi, Babuganj, Muladi, Lala, Bakharganj, Jhalakati, Gagon, Bhawanipur, *Kantakhali, Kazirchar, Bhola,* Daulatkhan, Perojpur, Matbaria, Parehat, Amrauri, Patherghata, Patuakhali, Barguna, Ranful, Kanakdi, Dhulia and Fulghuria.

Demonstration.

Introduction of superior varieties of seeds raised by the experts—The distribution of Indrasail selected by the Economic Botanist began in 1915. During the present year the following quantities were distributed :—

	1918-1919.
Dacca	750 Mds.
Mymensingh	725 ,,
Faridpur	50 ,,
Barisal	450 ,,
	1,975 Mds. (161,950 lbs.)

The automatic expansion of Indrasail has begun in the following important centres in Dacca and Mymensingh :—

Name of District.	Villages.
Dacca ...	Barabor, Pilkhana, Rayar bazar, Satmazit, Lalmati, Tangi, Sripur, Satkhamar, Kaprul, Tallabag, Kurmitotta, Channa, Kadda, Bason, Samantapur.
Mymensingh ...	Gaffargaon, Kotoali, Sarisabari, Bhairab, Jamalpur, Netrokona, Dhankhola, Charbasanti, Mohanpur, Ramnagar, Kathal, Gosthia, Kurmi, Ajagitola, Salthia, Gorsthan, Montala, Taral, Khudahar, Maizbari, Gangtia, Kalison, Atharabari.

The ryots now keep their own seeds and also supply their neighbours.

Kataktara Aus Paddy.

Thirty-eight maunds of the Economic Botanist's selected Kataktara Aus paddy were distributed in this division. In all the districts this variety gave a heavier yield than the local varieties. The demand for this paddy has increased enormously; but only 100 maunds are available for this division

for sale this year. But it is expected that a large quantity of seed will be available for sale next year.

Kakya Bombai Jute Seed.

The superiority of the Kakya Bombai Jute seeds over the local varieties is recognised by the cultivators; for not only does it give a higher yield, but the fibre has been selling at a premium of from annas 8 to Re. 1-8 per maund.

The area under this variety is increasing very rapidly automatically. In Kaliganj in the district of Dacca where some doubts were entertained by the President, Panchayats and the Secretary to the Union Committee as to the superiority of this variety, careful experiments were made by themselves and they are now fully convinced as to its better yield. The demand for the seed has been very strong; 200 maunds (16,400 lbs.), the amount allotted to my division for sale, were not sufficient even to meet the pressing needs of the district of Dacca alone.

Four hundred and fifteen maunds of seed were distributed as noted below in ¼-lb. packets to cultivators in areas which had not received Government seed before :—

Dacca	150 maunds	(12,300 lbs.).
Mymensingh	150 „	(12,300 „).
Faridpur	40 „	(3,280 „).
Barisal	75 „	(6,150 „).
Total ...	415 maunds	(34,030 lbs.).

It is estimated that cultivators have kept sufficient seed to sow 47,000 acres next year.

To guard against Rhizoctonia and Diplodia all seeds were treated with a solution of copper sulphate before being sent out. The standard of germination was very high.

Messrs. Sinclair. Murray & Co., Godenail, Narayanganj, Chittagong & Co., Mymensingh, and Messrs. Landale, Clark & Co., Sarisabari, continued demonstrations with this variety as in previous years and the results were favourable as will be seen below :—

Place.	Name of agency.	Area under Kakya Bombai in acres.	Outturn of Kakya Bombai.	Area under R.26 in acre.	Outturn of R.26.	Difference.
			Mds. srs. ch.		Mds. srs. ch.	Mds. srs. ch.
Mymensingh ...	Chittagong & Co.	·96	26 0 0	·96	6 0 0	20 0 0
Sarisabari ...	Landale, Clark & Co.	·25	6 20 0	·25	5 25 0	0 35 0

Messrs. Sinclair, Murray & Co.

Manure used	Area in acres.	Outturn. Mds. Srs. Ch.
Low land Kakya Bombai Jute—		
Lime, Hyacinth ash, Pot. Nitrate, Cowdung	... ·99	24 10 0
Diito (without lime)	... ·99	26 21 0
High land red Olitorius—		
Lime, Hyacinth ash, Pot. Nitrate	... ·08	1 15 0
Ditto (without lime)	... ·08	1 30 0
Green Olitorius—		
Lime, Hyacinth ash, Pot. Nitrate	... ·08	2 5 0
Ditto (without lime)	... ·08	2 25 0

Corchorus Olitorius (green and red varieties) was tried in Godenail and Sarisabari, but the result was unsatisfactory at the latter place owing to continuous rains during the weeding season.

Effect of Bonemeal.

The use of bonemeal for paddy is extending gradually. The cultivators in those localities where its value was demonstrated are now purchasing considerable quantities. During the year under report 220 maunds (18,040 lbs.) of bonemeal were sold from the seed stores. The average profit per acre is about Rs. 20 in the Dacca district. It was also noticed that at Channa Bhawal Estate paddy crops manured with bonemeal resisted the drought better than the unmanured crops.

Introduction of Potatoes.

Four hundred and seventy-two maunds (28,704 lbs.) of Darjeeling seed potatoes were supplied to cultivators in this division. Shop-keepers are now stocking seed potatoes in districts where the cultivation has been established.

At Bhairab the local cultivators deputed a man to buy 300 maunds in Darjeeling.

Public spirited Zamindars such as the Hon'ble Babu Brojendra Kishore Roy Choudhuri, Mymensingh, Hon'ble Babu Arun Chandra Singha Bahadur of Paikpara, Babu P. N. Tagore of Calcutta and the Manager, Tagore Raj Estate, advanced considerable sums for the purchase of seed potatoes for their tenants. The Collectors of Barisal and Mymensingh have also granted money from the Court of Wards' and Khasmahal Estates for the supply of Darjeeling seed potatoes.

The cultivation of this crop has now been established in many parts of this division; but the price of seed potatoes is too high for many who would like to take up the cultivation.

Sugarcane Cuttings.

The demand for sugarcane cuttings has been great. As the area under sugarcane in the Dacca Farm was not very large, an arrangement was made with a local grower to supply the cuttings of the Dacca Gandari, B.147 and B.208. Tanna was not available; the demand for this variety was also great.

The following table will show the number of cuttings supplied to the different districts :—

Dacca	...	...	...	17,000 cuttings.
Mymensingh	...	...	...	10,000 „
Faridpur	...	...	...	Nil.
Barisal	...	...	...	22,000 „
		Total	...	49,000 cuttings.

In Faridpur the supply was met from the last year's Gandari crop grown locally.

Introduction of new crops.

(1) **Tobacco.**—Tobacco both deshi and Motihari are being tried in the different districts. Burirhat Farm seed was obtained and distributed. The cultivation of tobacco is extending in the division, and, it is hoped, to further extend it and put the cultivators into touch with tobacco dealers. It will improve the financial condition of the cultivators.

(2) Introduction of transplanted paddy in Faridpur district.

(3) Introduction of groundnut in Barisal.—A crop grown in Mendhiganj was very successful.

Implements.

The Planet Junior hand-hoe, spring-toothed harrow and light iron plough were the useful implements tried during the year. As the price of the iron implements was high an attempt was made to introduce a light harrow and hoe devised by Babu Jamini Kumar Biswas, late Superintendent of Burirhat Farm. The hoe was found to work satisfactorily.

Village Seed-stores.

During the year under report construction of four seed-stores at a cost of Rs. 2,500 each has been started in the following centres in the Dacca Division :—

(1) Joydebpur.	(3) Narsingdi.
(2) Kaliganj.	(4) Munshiganj.

The Collector of Dacca has sanctioned from the Court of Wards' Estate a sum of Rs. 5,000 for stores at Jaydebpur and Kaliganj, and the District Board a sum of Rs. 5,000 for those at Narsingdi and Munshiganj. These stores are intended to serve as centres for the distribution of improved seed and manures to the cultivators and a small reading-room will also be provided where departmental publications, etc., will be available.

It is hoped that similar stores will be started in other districts. The District Agricultural Officers have begun a survey of crops in their districts thana by thana.

At present we have two agricultural associations in the Dacca district, one at Kaliganj and the other at Joydebpur. Similar associations will be started in other places and seed-stores opened to supply the demands for seed, etc.

Ufra.

Burning of stubble was continued as in the previous years. Besides, experiments were made in Dacca, Barisal and Faridpur in growing deep-water aus paddy in big blocks. Owing to the floods the crops were much damaged. The experiments conducted in Pubail, Nagari and Taghoria proved satisfactory.

Water Hyacinth.

The ash of water hyacinth is rich in potash and as such is a suitable manure for jute, and ryots are being persuaded to make ash and apply it to their land. An experimental plant was set up by the Agricultural Chemist at Naryanganj for the extraction of potassium chloride. Ash was sent in from Munshiganj and Madaripur to supplement that made locally. About 70 maunds of the chloride has already been produced.

Cotton.

Owing to the high price of cloth there was a demand for cotton seeds. About 115 maunds 23 seers of cotton seed were supplied free by Government. Owing to the continuous rainy weather during the sowing season, most of the crops failed, but in high-lands where there was no water-logging the plants grew fairly well.

The Dharwar American cotton will, it is expected, suit this division better than other varieties.

Exhibition.

The Faridpur Agricultural and Industrial Exhibition was held in January 1919. The prize distribution was attended by the Hon'ble Mr. J. G. Cumming. There was a strong demand to have seed-stores and demonstrations in every thana.

Divisional Seed-store.

The Dacca Seed-store was started in 1915. Since then it has been in direct charge of the Superintendent of Agriculture, Dacca Division, assisted by a clerk. The store has supplied a large quantity of seeds and manures as will be seen from the following :—

	Mds.	srs.	ch.
Cotton seeds—			
1. (*a*) Lyallpur cotton seeds	5	0	0
(*b*) Cambodian ditto	0	37	0
(*c*) Broach ditto	0	8	0
(*d*) Dhrawar American ditto	109	25	0
2. Bonemeal	400	25	0
3. Deep-water paddy	82	0	0
4. Indrasail paddy	15	0	0
5. Cowpea	1	20	0
6. Jute seeds	396	25	4
7. Pt. J. Hand-hoe	1 No.		
8. Dhaincha seeds	0	14	8
9. (*a*) Potato (Darjeeling)	881	20	8
(*b*) Do. (Nainital)	140	0	0

The accounts were kept in the printed forms prescribed by the Department. It will be seen from the subjoined statement that there has been a net profit of Rs. 324-7-3 after meeting the cost of house-rent and establishment charges The popularity of the seed-store has much increased. The ryots are coming of their own accord to purchase seeds and manures and have much appreciated the utility of such an institution in the heart of this town.

Acknowledgments.

Our best thanks are due to the District Administrative staff, to the Collectors, Subdivisional Officers, and to the Court of Wards' Estate for their kind help and co-operation. Special thanks are due to Rai Saheb Jogesh Chandra Datta, Mr. D. M. Sen, Subdivisional Officer, Dacca Sadar, Babu Sachi Kanta Ghose. Circle Officer, Dacca, and Mr. J. N. Banerjee, Private Secretary to the Bhawal Court of Wards' Estate, for the interest they have taken in works of the Department. All District Agricultural Officers have worked with zeal and devotion and deserve commendation.

JAMINI KUMAR BISWAS,

Superintendent of Agriculture, Dacca Division.

Statement of Assets and Liabilities of the Divisional Seed-store, Dacca, for 1918-19.

Assets—	Rs.	A.	P.	Rs.	A.	P.
Total amount in cash realised from sale in year under report	16,549	5	8			
Deduct—						
(1) Outstandings of last year realised in year under report	9,999	0	11			
(2) Miscellaneous receipts credited through the stores	1,081	14	0			
(3) For cotton seeds	187	8	0			
Cash receipts for current year				5,280	14	9
Bills outstandings	9,927	15	0			
Deduct bills for cotton seeds	796	13	3			
Do. on account of estimated bad debts and non-realisable (last year Rs. 743-1-9, this year Rs. 50)	793	1	9	8,338	0	0
				13,618	14	9

Liabilities—	Rs. A. P.	Rs. A. P.
Rent	1,660 0 0	
Deduct on account of rent for the office of the Superintendent of Agriculture and the District Agricultural Officers at Rs. 25 each ...	600 0 0	
Deduct rent for District Agriculture Officers, Barisal and Faridpur, at Rs. 20 each and Mymensingh at Rs. 30	820 0 0	240 0 0
Establishment	480 0 0	
Contingencies	551 12 6	
Depreciation on materials for storing at 5 per cent.	50 0 0	
Packing and freight charges	34 2 3	1,115 14 9
Cost of purchasing stores	14,226 4 0	
Deduct for cotton seeds	2,442 12 3	11,783 7 9
Cost price of stock in hand on 1st April 1918 ...	1,007 1 0	
Ditto ditto 31st March 1919 ...	180 0 0	
	827 1 0	
Deduct transfer of stock to Dacca Farm ...	672 0 0	155 1 0
		13,294 7 6
Profit and loss account		324 7 3
Sale-proceeds		13,618 14 9

ANNUAL REPORT OF THE SUPERINTENDENT OF AGRICULTURE, CHITTAGONG DIVISION, FOR 1918-19.

Introductory.

I took over charge of this division in August 1918 from Mr. Dwijadas Dutta, who was in charge of this division up to the end of July 1918.

Season.

The season was a very unfavourable one throughout the year. Late rainfall in the beginning delayed sowing of jute and paddy, whilst subsequent heavy showers interfered with proper weeding. Absence of rainfall in October was very harmful to the paddy crop.

The whole of Brahmanbaria Subdivision was flooded and hardly 25 per cent. of paddy and jute crops could be reaped. The crops in Noakhali were fair as the district is neither very low nor high; but serious damages were done to the crops by caterpillars and ufra.

The people of Chittagong were fortunate enough to harvest about a 95 per rent. crop of aman paddy.

Staff.

During the year under review I was assisted by 3 District Agricultural Officers and 17 fieldmen demonstrators of whom 14 were paid by the Agricultural Department and 3 by the Court of Wards' Estates. In addition to the above there were 15 temporary forecast clerks for distribution of Indrasail paddy and jute seed and 7 jute forecast clerks.

District Agricultural Officers were posted as follows :—

Babu Prafulla Kumar Das	...	Chittagong.
Babu Nalini Kanta Sen	...	Tippera.
Maulvi Muhammad Zainul Hoque	...	Feni (Noakhali).

Fieldmen demonstrators worked in the following revenue thanas :—

District Chittagong.—Fatickchari, Patiya, Chittagong Sadar, Mirsarai and Satkania.

One Court of Wards' man at Sitakunda.

District Tippera.—Comilla Sadar, Laksham, Kasba, Chandpur, Burichang.

Two Court of Wards' men at Brahmanbaria and Harashpur.

District Noakhali.—Harinarayanpur, Feni, Bashurhat, Chagalnaya.

Tours.

I was on tour for 202 days and visited almost all the centres of demonstration work; attended some of District Board meetings; made enquiries into the extent of damage done to agriculture and waterways by the spread of hyacinth weeds in the district of Noakhali; made arrangements for the extraction of potassium chloride from hyacinth ash in Noakhali; inspected the offices of the District Agricultural officers; made arrangements for demonstration work; and supervised jute forecast work and crop cutting experiments.

The District Agricultural Officer, Chittagong, was on tour for 161 days, the officer for Noakhali for 260 and the officer for Tippera for 211 days.

District work.

(I) INDRASAIL (DACCA No. 1).

Chittagong District.—Three hundred and twelve maunds or 25,584 lbs of Economic Botanist's Dacca No. 1 (Indrasail) paddy seed were distributed to 1,175 ryots in all the thanas of Sadar Subdivision. The result on high and medium transplanted lands was very satisfactory and superior to the local heavy yielding varieties on those classes of soils. A comparative statement of the crop-cutting results in the district will be found in Appendix I. From the figures it will be seen that Indrasail suited the high and medium lands but was unsuited to low-lying and saline lands. As the greater portion of the district is composed of high and medium paddy land, the introduction of Indrasail is an important improvement.

Tippera District.—Three hundred and seventy eight maunds or 30,996 lbs. of Indrasail seed were distributed in Sadar and Brahmanbaria Subdivisions. Everywhere in the Sadar Subdivision it has been a great success and its superiority over the local varieties is established. In low-lying alluvium lands of Brahmanbaria Subdivision (except at the foot of the hills round Kasba and Harashpur) the trials were not conclusive. The seedlings were damaged by the floods and owing to the floods even those saved could not be transplanted in time. The crop did very well all along the foot of the hills.

Noakhali District.—Two hundred and eighty maunds or 22,960 lbs. of Indrasail seeds were distributed in the following places :—

Sadar Subdivision.—Santasita, Munshirhat, Harinarayanpur, Choumuhan Bazra, Sonaimuri and Bashurhat.

Feni Subdivision.—Daganbhuan, Kazirhat, Abdul Munshi, Sarshadi and Munshirhat centres.

Everywhere the general yield of paddy (except in isolated cases where flood and insect-pests damaged the crop) was found to be higher than the local varieties. In saline tracts Indrasail was found unsuited to the conditions.

(II) KAKIYA BOMBAI JUTE SEED.

Tippera District.—Throughout the district 70 maunds 19 seers or 5,780 lbs. of seeds were distributed to 17,377 ryots in ¼-lb. bags. The crop grew very well all over the Sadar and Chandpur Subdivisions, and on enquiry it has been estimated that 60 per cent. of the ryots, supplied with seeds, have been able to preserve their seeds for the next sowing. In Brahmanbaria Subdivision about 75 per cent. of the crop was damaged by the flood and very little seed was saved for the next sowing.

Opinions were unanimous regarding the value of this jute. This year there is a great demand for the Departmental seeds from all over the district and ryots are willing to pay a higher price for our seed. Arrangements have been made for the sale of 50 maunds of jute seed in the Brahmanbaria Subdivision in co-operation with the Collector of the district.

Noakhali District.—In Noakhali the introduction of Kakiya Bombai was hindered by the late supply of the seed. About 9 maunds 25 seers or 788 lbs. of seed were supplied to 2,831 ryots, and it has been estimated that about 500 ryots have been able to preserve their seed for the next sowing.

Chittagong District.—In Banskhali, Rangamati and Patiya 21 ryots were supplied with Kakiya seed. The crop did not make any good growth in Rangamati and Patiya, while at Banskhali it grew fairly well and yielded a superior fibre. This year it has been decided to try the crop in a systematic way.

(iii) ECONOMIC BOTANIST'S KATAKTARA AUS PADDY.

Four maunds or 328 lbs. of Kataktara aus seed were distributed to some of the ryots in Patiya, Sitakunda and Sadar thanas. The variety was tried against the local heaviest yielders, *i.e.*, Chiknal aus and Bailam aus. The following statement will show how Kataktara fared with other varieties :—

Village.	NAME OF RYOT.	Variety.	Area of crop-cutting experiments.	Outturn.
Haidgaon ...	Abdussamad ...	Kataktara ...	$\frac{1}{10}$th acre ...	321 lbs.
	Matbar ...	Chiknal ...	Ditto ...	147 „
Goomdandi ...	Wahed Ali ...	Kataktara ...	Ditto ...	268 „
		Chiknal ...	Ditto ...	196 „
Uttar-Deyang ...	M. A. Sabur ...	Kataktara ...	Ditto ...	256 „
		Bailam ...	Ditto ...	235 „
Ditto ...	M. A. Samad ...	Kataktara ...	Ditto ...	205 „
		Bailam ...	Ditto ...	108 „
Patiya ...	Ashutosh Guha ...	Kataktara ...	Ditto ...	410 „

(iv) POTATOES.

Chittagong District.—Seventy-two maunds or 5,904 lbs. of Darjeeling and 32 maunds or 2,624 lbs. of Khasi Hill potatoes were purchased with the District Board money and distributed among the ryots of Sitakunda, Satkania, Fatickchari, Sadar, Mirsarai and Patiya thanas. The present condition of the crop is favourable. There was a great demand for seed potatoes from the ryots of Fatickchari thana and I had to arrange with one of the local merchants to supply Khasi Hill seed potatoes from Gauhati and this arrangement was satisfactory.

Tippera District.—Hundred maunds or 8,200 lbs. of Darjeeling seed potatoes were purchased with the District Board, Khasmahal and Court of Wards' Estate money for distribution among the ryots. On account of the high price of Darjeeling seed potatoes several ryots were advised to purchase Khasi Hill potatoes. At Burichang and Kasba some of the ryots preserved their seeds from the last year's Darjeeling crop and they have grown these seeds side by side with the fresh seed from Darjeeling.

The District Board of Noakhali made over to the District Agricultural Officer Rs. 1,000 for conducting experiments with potatoes, sugarcane and tobacco in the district. About 70 maunds or 5,740 lbs. of Darjeeling seed potatoes have been distributed among the ryots at Sadar and Feni Subdivisions.

(v) SUGARCANE.

Tippera District.—Seventeen thousand sugarcane setts of Dacca Gandari, B.147, B.208 and Vendhamukhi procured from a private farm near Dacca Farm are being tried in Chandpur, Brahmanbaria, Kasba and Burichang

Noakhali District.—Ten thousand sugarcane cuttings of different varieties are being tried in four demonstration centres.

Chittagong District.—There is an extensive cultivation of sugarcane all along the railway lines from Dhoom to Bhatiari. It is intended to introduce manures and better methods of cultivation and *gur*-making. The *gur* produced is of poor quality. In the village of Durgapur, thana Mirsarai.

Babu Nagendra Nath Das, Secretary to the Durgapur Agricultural Association, is growing very good crops of Tanna and Gandari canes manured with lime and bonemeal.

(vi) TOBACCO.

Noakhali District.—At Feni, Matihari tobacco has proved a great success, and it will be extended in suitable places in the district.

Chittagong District.—Three varieties of tobacco from Burirhat Farm have been supplied to the ryots of Patiya and Fatickchari thanas.

(vii) COTTON.

Twenty-two maunds or 1,804 lbs. of Dharwar cotton seed (American) and 25 maunds 20 seers or 2,091 lbs. of Hill cotton seed were distributed in the districts of Chittagong, Tippera and Noakhali for cold weather sowings. The distribution was chiefly done through the Khas Tahsildars and Subdivisional Officers of the districts. In certain places of Tippera the Dharwar seeds have grown well, but in the majority of cases, the crop failed to make any good growth on account of bad cultivation or drought.

(viii) NEW CROPS.

(i) **Groundnut** (**Arachis hipogia**).—Five maunds or 410 lbs. of groundnut seeds were distributed in Chittagong and Tippera. The crop grew well at Feni hills in Chittagong and Mainamuti hills at Tippera. The light soils on the slopes of the Tippera and Chittagong hills where no other successful crops can be grown, are suitable for groundnut cultivation and it has been decided to introduce the cultivation there.

(ii) **Elachi** (**Ammommum Sobulatum**).—The District Agricultural Officer, Chittagong, procured some 200 shoots from Darjeeling and distributed those in the hot valleys of Patiya, Sitakunda, Sadar and Fatickchari. In Fatickchari the shoots have grown well and probably will bear fruit within a year.

(iii) **Patal** (**Trichosanthes dioica**).—One hundred root cuttings and ten seers of patal creepers were distributed in the district of Chittagong. The root cuttings have germinated everywere, but the creepers have failed to grow.

(iv) **English vegetables.**—English vegetables seeds were supplied to *bhadralog* farmers in the towns of Chittagong, Feni and Comilla. Almost everywhere the crops were successful. This year it has been decided to supply seeds to the cultivating classes.

(v) **Dhaincha.**—I have seen ryots at Harinarayanpur (Noakhali), Kasba, Gopinathpur and Brahmanbaria (Tippera) growing Dhaincha for green-manuring their fields in growing transplanted paddy. The seeds were supplied by the Agricultural Department. They generally complain of losing their aus crop in following this method of manuring; for they always take a crop of aus paddy before transplanting aman.

(ix) SPECIAL CROPS OF THE DIVISION.

The crops of special interest grown in the division and which may be propagated in other parts of Bengal :—

Very good varieties of Rahar seeds are available in Tippera, while plenty of Sunn hemp seeds and sugarcane cuttings are procurable in the district of Chittagong.

Big varieties of "Ol" (*Arum Campanalatum*) and Kachu (*Colocasia Antiquorum*) are available in Chittagong Hill Tracts. A big variety of plantain (*Musa Sapiewtum*) called "Gerang" Kala is grown in Patiya and Satkania. "Patipata" (*Cypers Tagotum*) (Sital pati is made out of this crop) is extensively grown round almost all the homestead lands. A very hardy

variety of small potato too is grown in Satkania and this year it has been found that its size and taste can be made attractive by proper cutivation and manuring. Good Lichi grafts are available in Banskhali (Chittagong).

(x) MANURES.

(i) **Castor cake.**—Two hundred and fifteen maunds or 17,630 lbs. of milled castor cake were procured from Rajshahi Jail for manuring potatoes and sugarcane. In Sitakunda, Sadar, Patiya, Fatickchari and Satkania in the district of Chittagong potatoes were manured with castor cake. The plants are growing very luxuriantly and they are free from red-ants and other insect-pests. In Tippera the application of castor cake has given a very satisfactory result in the cultivation of jute and transplanted aman paddy, but the royts complain about its high price.

Excellent results have been obtained in Feni and Harinarayanpur, district Noakhali. by the application of castor cake on potatoes, sugarcane and transplanted paddy.

(ii) **Bonemeal.**—Very good results have been obtained in the jurisdiction of Burichang thana, district Tippera, by the application of bonemeal on paddy. The cultivators were so satisfied that they have ordered more. Good crops of sugarcane have been raised at Durgapur, thana Mirsarai, district Chittagong, by the application of bone and lime. In Noakhali, Harinarayanpur, where the soil is alluvium, the results are conflicting.

(iii) **Crushed lime-stone.**—Crushed lime-stone is extensively used at Durgapur, thana Mirsarai, district Chittagong, and the cultivators are now getting their own supply without any help of the Agricultural Department. It has been decided to demonstrate the value of lime and bone all over the red soil tract of this division.

(xi) IMPLEMENTS.

The working of chain pumps was demonstrated at Satkania, Brahmanbaria and Chandpur for irrigating potato fields. The ryots were satisfied with the working of the pumps and they are prepared to purchase them at pre-war rates.

(xii) CROP PESTS.

(i) **Ufra.**—This year "ufra" was particularly bad in the Noakhali and Tippera districts. The ryots were advised to burn the stubble and grow jute wherever possible. Leaflets dealing with ufra were distributed through the village schoolmasters to the sons of cultivators. There was a big demand for these pamphlets and the instruction is greatly appreciated.

(ii) **Water Hyacinth.**—This pest is very bad in Noakhali district, but the ryots are collecting the weed, burning it and using the ashes for manuring their paddy and jute fields. A plant has been set up at Sonaimuri (Noakhali) for the extraction of potassium chloride on an experimental scale.

(xiii) MISCELLANEOUS.

(i) **Agricultural Associations.**—There are Agricultural Associations at Durgapur, Zorowarganja, Patiya, Fatickchari and Satkania in the district of Chittagong, at Baduria in the district of Noakhali. The Noakhali Hitaishini Shava also takes some interest for the improvement of agriculture. Of all the associations, the Durgapur Association is the best.

(ii) **Exhibition.**—The Feni Agricultural and Industrial Exhibition was held in February. Improved implements such as Hand-hoes, spring-tooth harrows and iron ploughs were shown to the ryots. Excellent crops of tobacco and sugarcane grown in demonstration plot at Feni were shown to the public.

(iii) **Agricultural Education.**—The Headmaster, Durgapur High English School, has organised a scheme of agricultural education in his school

He has been able to acquire a piece of land close to the school. He has a good collection of agricultural books, seeds and geological specimens.

(iv) **Experimental Farms.**—The site of the old Chittagong Model Farm has been made over to the department. In the district of Tippera 20 acres of land have been acquired near the town of Comilla for an experimental farm. The farm buildings have been commenced and are expected to be finished soon.

(v) **Suggestions.**—There are numberless hill streams all along the hills from Chittagong to Haraspur (Tippera) and these streams can be made to irrigate the neighbouring tracts in the cold weather for growing of *rabi* crops if they are diverted by means of "anicuts" and "high level bunds," but these works are beyond the scope of the Agricultural Department and can only be taken up by the Irrigation Department.

(xiv) SEED-STORE.

During the year the following seeds, manures and implements were sold and distributed through the agency of the Seed-store, Chittagong :—

1.	Indrasail paddy seed	1,000	mds.
2.	Kataktara paddy seed	4	,,
3.	Puki paddy seed	2	,,
4.	Kakiya Bombai jute seed	80	,,
5.	Groundnuts	5	,,
6.	Dharwar American cotton seed	22	,,
7.	Hill cotton seed	25	,, 20 srs.
8.	Potato seed	284	,,
9.	"*Ol*" and *kachu* seed	10	,,
10.	English vegetable seed	300	pkts.
11.	Tobacco seed	10	tolas.
12.	Patal roots and creepers	15	seers.
13.	Sugarcane cuttings	30,000	Nos.
14.	Lichi grafts	100	,,
15.	Castor cake	215	mds.
16.	Bonemeal	50	,,
17.	Crushed lime-stone	80	,,
18.	Special phosphatic manures	6	,, 30 srs.

The statement of assets and liabilities showing the working of the seed-store will be found in Appendix II.

(xv) ACKNOWLEDGMENTS.

I am grateful to the Chairmen, Vice-Chairmen and Members of the District Boards of Chittagong, Tippera and Noakhali, for District Board grants in conducting experiments. Special mention may be made of Ray Bahadur Upendra Lal Roy of Chittagong, Khan Sahib Abdur Rashid Khan of Noakhali, Babu Anadi Ranjan Basu of Feni, Babu Monoranjan Maitra, Personal Assistant to Commissioner, Chittagong Division, and Babu Atul Chandra Bagchi, Circle Officer, Comilla, for their kind help and hearty co-operation.

KALIDAS RAY,

Offg. Superintendent of Agriculture,

Chittagong Division.

APPENDIX I.

Crop cutting experiments of Indrasail and other varieties of paddy in the district of Chittagong.

Thana.	Village.	Ryot's name.	Nature of the land.	Variety.	Area of crop cutting.	Outturn.
1	2	3	4	5	6	7
					Acre.	lbs.
Fhatickcheri ...	Horeralchari	Annar Ali ...	High trans-planted land.	Indrasail ...	1/10	287
				Birmali ...	1/10	184
Ditto ...	Safinagar ...	Abdul Rahim ...	Medium trans planted land.	Indrasail ...	1/10	205
				Shailchiknal ...	1/10	164
Ditto ...	Amtoli ...	Ram Ch. Dey ...	Lowlands ...	Indrasail ...	1/10	130
				Maiquri ...	1/10	300
Ditto ...	Solbanchari ...	Attarally ...	High ...	Indrasail ...	1/10	307
				Leugachikan ...	1/10	168
Ditto ...	Mandakini ...	Abdul Haque ...	Medium ...	Indrasail ...	1/10	209
				Dudkamal ...	1/10	180
Ditto ...	Chillonia ...	Ahmedulla ...	Lowlands ...	Indrasail ...	1/10	310
				Lalmoti ...	1/10	182
Patya ...	Jaithpara ...	Bacha Mia ...	High ...	Indrasail ...	1/10	209
				Gring ...	1/10	184
Do. ...	Gumdandi ...	Aparna Mahajan ...	Do. ...	Indrasail ...	1/10	213
				Nunasail ...	1/10	160
Do. ...	Akudandi ...	Asadali ...	Medium ...	Indrasail ...	1/10	202
				Dhaligarcha ...	1/10	164
Do. ...	Saidpur ...	Md. Yusuf Ali ...	Lowland ...	Indrasail ...	1/10	172
				Maidal ...	1/10	229
Do. ...	Padadia ...	Kamini K. Dey ...	Ditto ...	Indrasail ...	1/10	159
				Basmoti ...	1/10	223
Mirsarai ...	Khoyachera ...	Sarat Ch. Bal ...	High ...	Indrasail ...	1/10	196
				Mohitpan ...	1/10	150
Ditto ...	Ditto ...	A. C. Dutta ...	Do. ...	Indrasail ...	1/10	290
				Chaplais ...	1/10	210
Ditto ...	Takia ...	Abduluddin ...	Medium ...	Indrasail ...	1/10	170
				Kartickla ...	1/10	100
Ditto ...	Imampur ...	Sayed Mia ...	Ditto ...	Indrasail ...	1/10	305
				Chaplais ...	1/10	280
Ditto ...	Durgapur ...	Barada Mazumdar ...	Lowlying ...	Indrasail ...	1/10	290
				Mohitpan ...	1/10	320
Ditto ...	Mothbaria ...	Girish Ch. Nag ...	Ditto ...	Indrasail ...	1/10	130
				Garcha ...	1/10	300
Sitakunda ...	Sitakunda ...	Zamiuddin ...	Highlands ...	Indrasail ...	1/10	246
				Raishal ...	1/10	197
Ditto ...	Ditto ...	Prasanna Dey ...	Ditto ...	Indrasail ...	1/10	246
				Shailchiknal ...	1/10	153
Ditto ...	Ditto ...	Har Kanta Mossaddi	Medium ...	Indrasail ...	1/10	205
				Kamarbail ...	1/10	164
Ditto ...	Ditto ...	Sarada Dey ...	Lowlying ...	Indrasail ...	1/10	153
				Lalbinni ...	1/10	164
Ditto ...	Ditto ...	Ali Mia ...	Ditto ...	Indrasail ...	1/10	143
				Kamarboil ...	1/10	184
Satkania ...	Madersa ...	Fazarali ...	High ...	Indrasail ...	1/10	232
				Amonishal ...	1/10	147
Ditto ...	Kanchana ...	Fazar Rahaman ...	Do. ...	Indrasail ...	1/10	123
				Nunasail ...	1/10	92
Ditto ...	Ditto ...	Kamini Dey ...	Medium ...	Indrasail ...	1/10	241
				Gelon ...	1/10	180
Ditto ...	Madersa ...	Alimoddin ...	Lowlying ...	Indrasail ...	1/10	147
				Kashlichukan ...	1/10	228
Sadar ...	Nasirabad ...	Hakimally ...	High ...	Indrasail ...	1/10	224
				Laigachikan ...	1/10	172
Do. ...	Baklarpur ...	Keramatali ...	Lowlying ...	Indrasail ...	1/10	143
				Beti ...	1/10	205
Roazan ...	Sultanpur ...	.....	Medium ...	Indrasail ...	1/10	238
				Pinjal ...	1/10	230

APPENDIX II.

Statement of Assets and Liabilities of the Chittagong Divisional Seed-store for 1918-19.

Assets.

	Rs. A.	Rs. A. P.	Rs. A. P.
Total amount in cash realised from sale during the year under report		3,948 11 6	
Deduct outstanding of last year realised during the year under report		1,495 4 0	
Cash receipt for the current year		...	2,453 7 6
Bills outstanding		2,088 6 3	
Deduct Amount to be written off		1,634 0 0	454 6 3
Total sale-proceeds		...	2,907 13 9
Loss ...			1,266 15 0
			4,174 12 9

Liabilities.

	Rs. A. P.	Rs. A. P.	Rs. A. P.
Rents	977 12	...	
Less rent for the office of the Superintendent of Agriculture		360 0 0	
Ditto of the District Agricultural Officer, Tippera		120 0 0	
Ditto of the District Agricultural Officer, Noakhali		110 0 0	
Ditto of the District Agricultural Officer, Chittagong		80 0 0	
		670 0 0	
			307 12 0
Establishment		...	885 0 0
Contingencies		...	386 14 3
Packing and freight charges		...	140 1 0
Cost of purchasing stores		...	1,931 3 6
Stock in hand on 1st April 1918		1,843 4 9	
Ditto 31st March 1919		1,919 6 9	
Bill payable		690 0 0	523 14 0
			4,174 12 9

ANNUAL REPORT OF THE DACCA CENTRAL FARM FOR 1918-19.

Introduction.

The farm is situated 5 miles north of the Railway Station near the village of Manipur.

The total area of the farm is 3,537 acres, 215 acres being under cultivation, the remainder utilized for buildings, roads and pasture.

The land may be classified under the following groups :—

High land.
Intermediate land.
Ravine or low land.

On the high land the soil is red laterite, hard and difficult to cultivate in dry weather, but it is typical of a large tract including the Madhupur jungle. The low lands are suitable for growing transplanted winter paddy.

During the period under report an experimental tank has been excavated for the Economic Botanist. Levelling and laying out have been continued.

Rainfall and temparature.

Tables showing the rainfall and the temperatures of the year are given in Appendix I. It will be seen that the season was dry at the outset for aus paddy, jute and sugarcane. At the time of transplanting of winter paddy the rainfall was normal but drought seriously affected this crop later. It was found necessary to irrigate the sugarcane crop.

Varieties.

(*a*) **Paddy (Oryza sativa).**—Only Kataktara aus paddy was grown on the farm. The average outturn was 1,400 lbs. Transplanted winter paddy (Indrasail) was grown on the low lands. The average outturn was 1,440 lbs. As stated above the crop suffered on account of drought. All the seed produced will be sent to the districts.

(*b*) **Sugarcane (Saccharum Officinarum).**—The examination of varieties of Bengal and exotic sugarcanes by the Agricultural Chemist was continued on $\frac{1}{20}$th acre plot.

The results are given in Appendix II.

(*c*) **Jute.**—Details will be found in the report of the Fibre Expert.

Experiments.

(*a*) These were conducted in collaboration with the Economic Botanist, Fibre Expert, Agricultural Chemist, and details will be found in their respective reports.

(*b*) The permanent manurial experiments initiated by Messrs. Birt, Basu and Meggitt were continued. Results will be found in Appendix III.

(*c*) The results obtained by the use of bonemeal and rock phosphate supplemented by ammonium sulphate on aus paddy are given in Appendix IV.

(*d*) Steamed and unsteamed bonemeal, oil-cakes and rock phosphate were tried on transplanted winter paddy. Results will be found in Appendix V.

Even in such an unfavourable season, the results are marked.

Fodder.

About 18 acres were put under fodder crops, 6·8 acres under maize and the rest under joar. Maize in the green stage was ensilaged in underground pits and gave excellent fodder for the cattle at a time of year when green fodder was scarce. Joar was fed to the cattle.

Implements and Machinery.

The following were used in the Farm:—Punjab plough, S. T. Harrow, Zig-Zag Harrow, Norwegian Harrow, Disc Harrow, Cambridge roller, Planet Junior hand-hoe and Winnower. An engine driven pump was used for irrigation.

Cattle.

The general condition of the cattle was good. There was one death due to old age.

Receipts and expenditure.

The total receipts were Rs. 2,962-5-6 excluding the value of Kataktara aus paddy and Indrasail paddy seed made over to the Dacca Farm Seed Stores and the total expenditure during the year amounted to Rs. 55,845 (including experimental and capital charges, petty construction and repairs laying out and reclamation).

Visits.

The Farm was visited by His Excellency the Governor of Bengal, His Honour the Chief Commissioner of Assam, the Hon'ble Sir H. Wheeler,

the Hon'ble Mr. J. G. Cumming, the Hon'ble Mr. L. Birley, the Commissioner of Dacca Division, the Collector of Dacca, etc. The Imperial Mycologist visited the Farm twice. The Panchayati Conference of the district was held at the Farm, His Excellency the Governor of Bengal presiding. The experiments conducted on the Farm were explained to the President Panchayats and others, and keen interest was shown in the work of the department.

Staff.

During the period under report Babu Santi Prosad Sen Gupta was in charge of the Farm. He was assisted by a staff of three overseers and two clerks.

Farm Seed-store.

This was in charge of the Farm Superintendent assisted by an overseer. The amount stocked in the year under report is given below :—

Kataktara aus paddy	60,160 lbs.
Transplanted winter paddy (Indrasail paddy)	53,520 ,,

The assets and liabilities of this store during the year will be found from the following statement :—

ASSETS OR RECEIPTS.			LIABILITIES OR CHARGES.		
Items.	Amount.	Amount.	Items.	Amount.	Amount.
	Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.
Total amount credited to the treasury in year under report.	4,383 1 3		Establishment ...	408 0 0	408 0 0
			Contingency including railway freight, etc.	6,798 5 0	6,798 5 0
Deduct outstanding of last year realised in year under report	53 3 9		Labour and carts supplied from farm.	572 13 0	572 13 0
Cash receipts of the current year.	...	4,329 13 6	Cost of purchasing stores.	21,716 15 3	21,716 15 3
			Stock in hand on 1st April 1918.	10,113 1 6	
Bills outstanding ...	5,538 13 3				
Deduct on account of bad debts non-realizable of last year.	965 14 3	4,572 15 0	Stock in hand on 31st March 1919.	2,728 15 0	
			Reduction in stock ...	...	7,384 2 6
Total sale-proceeds ...	...	8,902 12 6	Unpaid bills ...	1,031 9 6	1,031 9 6
			Deduct in connection with free distribution of seed—		37,917 13 6
			Contingency ...	6,200 0 0	
			Jute and paddy seed.	24,206 9 6	30,406 9 6
			Total ...	...	7505 4 0
			Profit and loss account	...	1,397 8 6
					8,902 12 6

K. McLEAN,

Deputy Director of Agriculture,

Eastern Circle.

APPENDIX I.

The maximum and minimum temperatures, 1918-19.

Month.	Outside.		Inside.	
	Maximum.	Minimum.	Maximum.	Minimum
1918.				
February	88·9	56·6	80·4	55·6
March	94·0	70·8	91·3	67·4
April	72·3	76·8	84·3	70·0
May	74·8	88·4	76·0	91·5
June	75·7	84·3	77·3	86·1
July	77·5	87·5	79·1	90·8
August	86·0	77·5	91·2	80·1
September	90·3	81·3	89·1	80·3
October	89·8	94·5	86·9	104·2
November	76·6	93·6	77·9	105·7
December	75·3	100·9	80·2	99·4
1919.				
January	63·8	87·4	69·5	89·1

Rainfall from February 1918 to January 1919.

Month.	Normal.		Actual.	
	Rainfall in inches.	Days.	Rainfall in inches.	Days.
1918.				
February	1·12	1·8	Nil	Nil
March	2·59	3·5	4·52	6
April	4·00	6·7	3·84	7
May	9 60	11·3	8·28	17
June	13·38	15·2	10·69	24
July	12·85	15·75	12·98	18
August	12·53	17·40	17·96	23
September	9·43	11·70	4·98	16
October	4·91	5	0·95	2
November	0·81	1·1	Nil	Nil
December	0·15	0·4	Nil	Nil
1919.				
January	0·38	0·9	0·24	2

APPENDIX II.

Results of Sugarcane plot, 1918-19.

Serial No.	Name of variety.	Area of plot in acres.	Weight of cane per plot.	Weight of juice per plot.	Weight of gur per plot.	Weight of gur per plot in lbs.	Weight of gur per acre in lbs.
			Mds. sr. ch.	Mds. sr.	Mds. sr. ch.		
1	Yellow Tanna ...	·05	27 38 0	18 0	2 11 0	182	3,640
2	Dacca Gandar ...	·05	24 7 0	14 0	2 20 7	201	4,020
3	J.247 ...	·05	28 35 0	17 20	2 26 4	213	4,260
4	Red Mauritius ...	·05	28 20 0	14 25	1 36 12	154	3,080
5	Yellow Tanna ...	·05	28 4 0	18 0	2 5 0	165	3,300
6	J.247 ...	·05	31 8 0	19 0	3 4 0	248	4,960
7	J.247 ...	·05	32 10 0	20 0	3 1 4	243	4,860
8	J.247 ...	·05	29 29 8	18 0	3 3 12	248	4,960
9	Red Mauritius ...	·05	32 37 0	23 20	3 6 0	252	5,040

APPENDIX III.

North Hazi Experimental plots, 1918-19.

Yields per acre of plots $\frac{1}{16}$th acre each.

[Kharif Crop in roman print and Rabi Crop in italic.]

→N

	1	2	3	4	
Cowdung 100 maunds per acre annually.	Aus 1,754 lbs. *Matikalai 96 lbs.*	Aus 1,574 lbs. *Matikalai 104 lbs.*	Aus 1,640 lbs. *Matikalai 80 lbs.*	Aus 1,082 lbs. *Matikalai 40 lbs.*	*d*
Bonemeal 3 maunds and cowdung 100 maunds per acre annually.	Aus 1,697 lbs. *Matikalai 96 lbs.*	Aus 1,395 lbs. *Matikalai 112 lbs.*	Aus 1,426 lbs. *Matikalai 48 lbs.*	Au 992 lbs. *Matikalai 80 lbs.*	*c*
Bonemeal 3 maunds per acre annually.	Aus 885 lbs. *Matikalai 16 lbs.*	Aus 606 lbs. *Matikalai 48 lbs.*	Aus 278 lbs. *Matikalai 40 lbs.*	Aus 28 lbs. *Matikalai 96 lbs.*	*b*
Nil.	Aus 426 lbs. *Matikalai 32 lbs.*	Aus 159 lbs. *Matikalai 16 lbs.*	Aus 287 lbs. *Matikalai 24 lbs.*	Aus 34 lbs. *Matikalai 48 lbs.*	*a*

C

	1	2	3	4	
	Aus 2,033 lbs. *Matikalai 64 lbs.*	Aus 1,918 lbs. *Matikalai 96 lbs.*	Aus 1,569 lbs. *Matikalai 56 lbs.*	Aus 1943 lbs. *Matikalai 40 lbs.*	*d*
	Aus 1,394 lbs. *Matikalai 64 lbs.*	Aus 2,066 lbs. *Matikalai 88 lbs.*	Aus 1,984 lbs. *Matikalai 72 lbs.*	Aus 1,771 lbs. *Matikalai 32 lbs.*	*c*
	Aus 1,631 lbs. *Matikalai 104 lbs.*	Aus 1,738 lbs *Matikalai 40 lbs.*	Aus 885 lbs. *Matikalai 24 lbs.*	Aus 1,590 lbs. *Matikalai 24 lbs.*	*b*
	Aus 705 lbs. *Matikalai 88 lbs.*	Aus 1,246 lbs. *Matikalai 8 lbs.*	Aus 869 lbs. *Matikalai 8 lbs.*	Aus 1,030 lbs. *Matikalai 16 lbs.*	*a*

D

	1	2	3	4	
Cowdung 100 maunds per acre annually.	Aus 2,245 lbs. *Matikalai 88 lbs.*	Aus 2,205 lbs. *Matikalai 32 lbs.*	Aus 2,246 lbs. *Matikalai 64 lbs.*	Aus 2,180 lbs. *Matikalai 80 lbs.*	*d*
Bone eal 3 maunds and cowdung 100 maunds per acre annually.	Aus 2,296 lbs. *Matikalai 80 lbs.*	Aus 2,205 lbs. *Matikalai 48 lbs.*	Aus 2,091 lbs. *Matikalai 80 lbs.*	Aus 2,164 lbs. *Matikalai 80 lbs.*	*c*
Bonemeal 3 maunds per acre annually.	Aus 1,820 lbs. *Matikalai 40 lbs.*	Aus 1,689 lbs. *Matikalai 32 lbs.*	Aus 1,230 lbs. *Matikalai 24 lbs.*	Aus 705 lbs. *Matikalai 80 lbs.*	*b*
Nil.	Aus 1,574 lbs. *Matikalai 96 lbs.*	Aus 2,255 lbs. *Matikalai 48 lbs.*	Aus 2,000 lbs. *Matikalai 24 lbs.*	Aus 1,476 lbs. *Matikalai 48 lbs.*	*a*

A

	1	2	3	4	
	Aus 1,787 lbs. *Matikalai 48 lbs.*	Aus 1,672 lbs. *Matikalai 48 lbs.*	Aus 1,049 lbs. *Matikalai 56 lbs.*	Aus 1,000 lbs. *Matikalai 24 lbs.*	*d*
	Aus 1,723 lbs. *Matikalai 104 lbs.*	Aus 1,525 lbs. *Matikalai 56 lbs.*	Aus 1,098 lbs. *Matikalai 32 lbs.*	Aus 1,197 lbs. *Matikalai 80 lbs.*	*c*
	Aus 992 lbs. *Matikalai 24 lbs.*	Aus 541 lbs. *Matikalai 40 lbs.*	Aus 721 lbs. *Matikalai 56 lbs.*	Aus 803 lbs. *Matikalai 16 lbs.*	*b*
	Aus 951 lbs. *Matikalai 24 lbs.*	Aus 475 lbs. *Matikalai 80 lbs.*	Aus 604 lbs. *Matikalai 48 lbs.*	Aus 246 lbs. *Matikalai 72 lbs.*	*a*

B

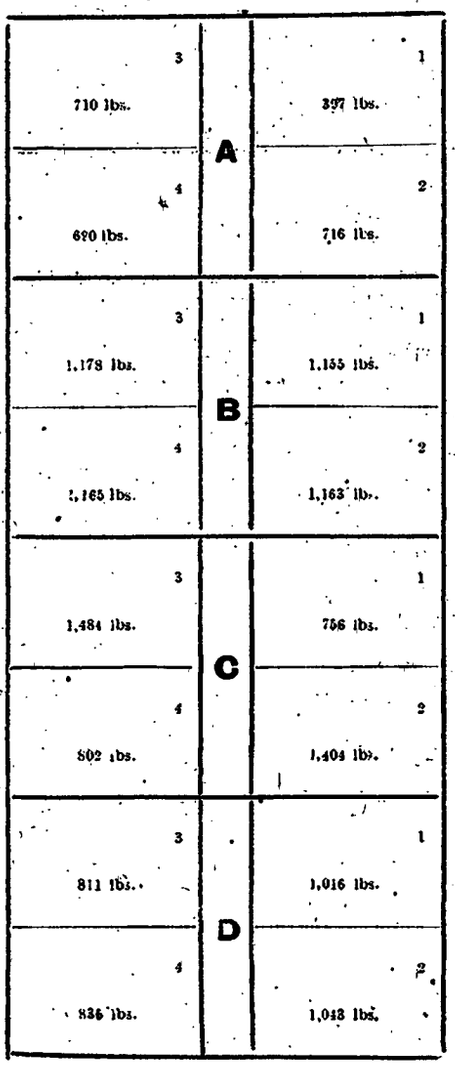
	Nil.	Lime 10 maunds per acre annually.	Lime 30 maunds per acre every third year (years 1911, 1914, 1917).	Lime 60 maunds per acre every sixth year (years 1911 and 1917).
	Nil.	Lime 10 maunds per acre annually.	Lime 30 maunds per acre every third year (years 1911, 1914, 1917).	Lime 60 maunds per acre every sixth year (years 1911 and 1917).

APPENDIX III—*continued.*

Manurial Experiments, Mr. Basu's Plot, 1918-19.

YIELDS PER ACRE OF PLOTS $\frac{1}{4}$TH ACRE EACH.

Crop—Puki Aus Paddy.



Manurial Scheme.

A1, D2—No manure.

A2, D1—Lime at 10 maunds per acre.

A3, D4—Bonemeal at 3 maunds per acre.

A4, D3—Lime and bonemeal at 10 maunds and 3 maunds, respectively, per acre.

B1, C2—Green-manure and lime at 10 maunds per acre.

B2, C1—Green-manure.

B3, C4—Lime and bonemeal at 10 maunds and 3 maunds, respectively, per acre and green-manure.

B4, C3—Bonemeal at 3 maunds per acre and green-manure.

APPENDIX III—*concluded.*

Manurial Experiments, Mr. Meggitt's Plot, 1918-19.

YIELD PER ACRE OF PLOTS (AREA OF EACH PLOT NOTED BELOW).

Crop—Kataktara Aus Paddy.

9	8	7	6	5	4	3	2	1
1,845 lbs.	1,393 lbs.	912 lbs.	662 lbs.	1,004 lbs.	1,317 lbs.	1,250 lbs.	1,148 lbs.	1,014 lbs.

Area of plots.		*Manurial Scheme.*
No. 1	0·10 acre.	No. 1. Bonemeal 1 maund and cowdung 100 maunds per acre.
„ 2	0·10 „	„ 2. Flour phosphate 1 maund and cowdung 100 maunds per acre.
„ 3	0·10 „	„ 3. Ditto ditto.
„ 4	0·10 „	„ 4. Ditto ditto.
„ 5	0·10 „	„ 5. Bonemeal 1 maund and cowdung 100 maunds per acre.
„ 6	0·10 „	„ 6. Ditto ditto.
„ 7	0·33 „	„ 7. No manure.
„ 8	0·15 „	„ 8. Cowdung 100 maunds per acre.
„ 9	0·15 „	„ 9 Ditto ditto.

APPENDIX IV.

Manurial Experiments, East Shuti Plot, 1918-1

YIELD PER ACRE OF PLOTS $\frac{1}{12}$TH ACRE EACH.

Crop—Kataktara Aus Paddy.

11 1,538 lbs.	1 1,536 lbs.
12 1,608 lbs.	2 1,404 lbs.
13 1,476 lbs.	3 1,524 lbs.
14 1,872 lbs.	4 1,572 lbs.
15 1,716 lbs.	5 1,416 lbs.
16 1,812 lbs.	6 1,200 lbs.
17 2,160 lbs.	7 1,656 lbs.
18 2,160 lbs.	8 1,416 lbs.
19 2,328 lbs.	9 1,896 lbs.
20 2,148 lbs.	10 1,764 lbs.
a 2,100 lbs.	*g* 1,944 lbs.
b 1,920 lbs.	*h* 1,728 lbs.
c 2,064 lbs.	*i* 1,248 lbs.
d 1,860 lbs.	*j* 1,320 lbs.
e 1,728 lbs.	*k* 1,248 lbs.
f 2,016 lbs.	*l* 1,416 lbs.
o 1,416 lbs.	*m* 1,308 lbs.
p 1,848 lbs.	*n* 1,146 lbs.

Manurial Scheme.

Plots—4, 9, 12, 17, *b*, *d*, *f*, *g*, *h*, *m*, *p*.

Bonemeal at 480 lbs. per acre.

Ammonium Sulphate at 54 lbs. per acre.

3, 7, 13, 18, *a*; *c*, *j*, *k*, *n*, *o*.

Rock Phosphate at 360 lbs. per acre.

Ammonium Sulphate at 154 lbs. per acre.

1, 2, 5, 6, 8, 10, 11, 14, 15, 16, 19, 20, *e*, *i*, *l*.

Ammonium Sulphate at 154 lbs. per acre.

APPENDIX V.

Manurial Experiment, East Ravine Plot, 1918-19.

YIELD PER ACRE OF PLOTS $\frac{1}{10}$TH ACRE EACH.

Crop—Indrasail Paddy.

11 2,460 lbs.	9 2,520 lbs.	7 2,140 lbs.	5 1,890 lbs.	3 1,600 lbs.	1 1,610 lbs.
12 2,730 lbs.	10 2,450 lbs.	8 1,990 lbs.	6 2,130 lbs.	4 1,840 lbs.	2 1,490 lbs.

Manurial Scheme.

Plots—1 and 4	...	I. O. P. Cake.	300 lbs. per acre.
2 and 3	...	Mustard cake.	370 ,, ,,
5 and 6	...	Shrimp Waste.	300 ,, ,,
7, 10, 11	...	Steamed Bonemeal.	240 ,, ,,
9 and 12	...	Unsteamed Bonemeal	250 ,, ,,
8	...	No Manure.	

Manurial Experiment, Sunti Low Plot, 1918-19.

YIELD PER ACRE OF PLOTS $\frac{1}{3}$RD ACRE EACH.

Crop—Indrasail Paddy.

4 1,007 lbs.	9 1,087 lbs.
3 1,134 lbs.	8 1,386 lbs.
2 956 lbs.	7 793 lbs.

Manurial Scheme.

Plots—2 and 9	...	No manure.
3 and 7	...	Rock Phosphate at 360 lbs. per acre.
4 and 8	...	Bonemeal at 240 lbs. per acre.

ANNUAL REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, WESTERN CIRCLE AND NORTHERN CIRCLE, FOR 1918-19.

I continued as Deputy Director of Agriculture, Eastern Circle including Dacca, Chittagong and Rajshahi Divisions) till the 3rd February, when Mr. McLean returned from military duty and relieved me. I took over charge of the Western Circle on the 31st January, 1919 from Mr. F. Smith, who has gone on leave for 14 months. Mr. Smith was on tour for 173 days and visited the following places :—

Kurseong.	Hooghly.
Kalimpong.	Kharagpur.
Darjeeling.	Asansol.
Birbhum.	Khulna.
Bankura.	Jessore.
Burdwan.	Nadia.
Midnapore.	Berhampur.
Howrah.	Baraset.

Dacca.

He attended a conference, on the production of jam and jelly, held at Simla in April, 1918. During February and March I spent altogether 44 days on tour and visited the following districts, in connection with the inspection of farms, divisional seed stores and demonstration :—

Howrah.	Nadia.
Hooghly.	24-Parganas.
Burdwan.	Rajshahi.
Midnapore.	Bogra.
Berhampur.	Rangpur.
Khulna.	Pabna.
Jessore.	Dacca (in connection with the Social Service League Exhibition).

Staff.

2. In the Western Circle there are two Superintendents of Agriculture, viz., one in the Burdwan, and the other in the Presidency, Division, and eight District Agricultural Officers in Bankura, Birbhum, Midnapore, Jessore, Nadia, 24-Parganas, Burdwan and Hooghly. Besides these, two additional temporary officers have been appointed in the district of Birbhum. owing to the expansion of the demonstration work. The District Boards of Hooghly and Midnapore also maintain additional District Agricultural Officers of their own.

In the Burdwan Division, there are seventeen demonstrators, of whom ten are employed by the Department, five by the District Boards, one by the Ward's Estate and one by the Trust Estate. Four temporary men are also engaged in Bankura for cotton cultivation. In the Presidency Division there are 11 demonstrators maintained by the Department and two by the Ward's Estate. For the jute forecast work thirty-two men were engaged for four months in the Burdwan and Presidency Divisions.

In the Northern Circle (Rajshahi Division) there is one Superintendent of Agriculture and a District Agricultural Officer for each district in the division, except Darjeeling. There are fifteen demonstrators, of whom twelve are paid by Government and three by the Ward's Estate. Twenty-five temporary men were employed for the jute forecast work. The services of the latter were afterwards retained for the seed distribution work in the flood affected areas of Rajshahi and Bogra districts.

Season.

3. The season was very unfavourable throughout the year and badly affected both the Kharif and the Rabi crops. Deficient monsoon in the beginning

of the year delayed the preparation of land, while the heavy and incessant rainfall from May to August damaged the jute and cotton crops. The continued drought in the latter part of the year seriously damaged the growth of paddy, sugarcane and all rabi crops.

Agricultural Stations.

4. In the Western Circle there are two farms, viz., Burdwan and Chinsurah, and in the Northern Circle five, viz., the Kalimpong Home Farm, the Rajshahi Farm, the Rangpur Cattle Farm, the Burirhat Tobacco Farm and the Rangpur Demonstration Farm. Steps have been taken during the year to open a district farm at Bogra.

(*a*) **Burdwan Farm.**—The crop results were unsatisfactory. Constant changes of the Superintendents have seriously told against the working of the farm. About 75,000 cuttings of improved varieties of sugarcane were distributed to the cultivators.

(*b*) **Chinsurah Farm.**—The experiments deal mostly with paddy, jute and sugarcane. Kataktara aus paddy was grown with great success. The production of improved paddy and jute seeds for distribution throughout the province was continued. About 2,079 maunds of Indrasail paddy and 343 maunds of Nagra paddy were supplied by this farm during the year for seed purposes. Seed selection with paddy and jute was conducted under the guidance of the Economic Botanist and the Fibre Expert. Of all the varieties of sugarcanes Tana was found to be the best as regards the production of *gur*, yielding an increased outturn of about 60 maunds of *gur* per acre over Shamshara, the best of the local varieties. About 65,000 cuttings of selected varieties of cane were distributed from this farm during the year.

The newly reclaimed tank was stocked with fry under the guidance of the Director of Fisheries.

Kalimpong Farm.—As in the previous year, different experiments were made with Maize and Kodo paddy (both aman and aus), buckwheat, soy beans, potato, sugarcane, fruit trees and vegetables. Maize and Kodo were found most profitable crops for these hills. As the English fruit trees did not thrive well Japanese and Australian fruit trees are being tried. It is also found that the Nepali soy bean produces very little when grown mixed with maize, but yields heavily when grown by itself.

Rajshahi Farm.—Varietal experiments with sugarcane, jute, potato, cotton, etc., were continued. Paddy, jute, wheat, gram, etc., were also grown for seed production. Several varieties of fodder crops were tried with success.

The farm also contributed to the multiplication of the improved races of jute and paddy. About 21,225 cuttings of improved varieties of cane were distributed during the year.

(*d*) **Rangpur Cattle Farm.**—The modified policy of the farm, systematizing the cattle breeding experiment for the general improvement of the indigenous cattle, has been confirmed.

The system of the retail supply of milk has been replaced by selling all the milk to a wholesale agent, who has undertaken to retail the milk to the townspeople. This has relieved the farm staff of a considerable amount of unnecessary work and has given them opportunities to concentrate their attention on experimental work in a much more thorough and systematic manner.

(*e*) **Burirhat Farm.**—Selection work and manurial experiments with tobacco was the chief work of the farm. Kataktara aus paddy was also tried against local aus with success. The combined curing and cattle shed, erected at the farm at the instance of Mr. Milligan, has proved quite satisfactory, and it has been adopted as a model by some of the surrounding cultivators.

(*f*) **Rangpur Demonstration Farm.**—The whole farm has been laid out in regular 1-10 acre plots. Economic Botanist's Indrasail and Kataktara have been tried and demonstrated to be superior to local varieties. Fibre Expert's jute was also grown for multiplication. Other crops grown are sugarcane, potato, cotton, mustard, etc. Among the sugarcane varieties Tana

has kept its reputation as the best. Of the potato varieties the Darjeeling retains its reputation of being the heaviest yielding variety.

Seed Stores.

5. Besides the three Divisional Seed Stores under three Superintendents of Agriculture in the Burdwan, Presidency and Rajshahi Divisions there are District stores in all the districts (except Darjeeling) in Northern Bengal and three in the Burdwan Division, viz., Birbhum, Bankura and Burdwan. Great interest is evinced in regard to the starting of rural seed stores in connection with Agricultural Associations, but it has not been possible to do much in this direction for want of proper staff.

For the distribution of seeds of rabi crops in the flooded area of Bogra and Rajshahi twelve temporary stores were opened at various places of both the districts. The seeds were purchased by this Department and issued by the respective Collectors of the districts, as loan, to individual cultivators. About 3,170 maunds of seeds of Khesari, lentils, gram, linseed, mustard and wheat were distributed for sowing an estimated area of 11,734 acres of land in the flooded area.

Demonstrations.

6. (*a*) **Crops.**—In both the circles about 200,000 lbs. of seeds of Indrasail paddy, 26,000 lbs. of Kakya Bombai jute and 5,000 lbs. of Kataktara aus paddy were distributed among the cultivators and in the majority of cases they proved their superiority over the local varieties. Kataktara aus paddy has met with so much success that its demand has exceeded all bounds. Arrangements have already been made to distribute during this season about 400 maunds of Kakya Bombai jute seed and 2,500 maunds of Indrasail paddy seed in the Northern Circle alone.

Sugarcane.—The Tana variety of sugarcane has proved very successful. More than 2 lakhs of cuttings were distributed among the cultivators. Increased areas are being put under this crop in the farms to meet the demand, which is rising every year.

The area under groundnuts in the Burdwan Division is increasing gradually, and it is gratifying to learn that the land lying waste from time immemorial in Birbhum is being taken on lease by cultivators for the cultivation of this crop. Groundnuts are also being introduced in certain localities in the Presidency Division.

The cultivators of Birbhum, Bankura and Midnapore appear to have made great progress in potato cultivation during the last few years. The Darjeeling variety continues to give the best outturn in both the circles.

The cultivation of Sumatra tobacco has increased considerably around the Burirhat Farm and in some parts of Rangpur district.

Dharwar cotton seeds were supplied to the cultivators in the districts of Birbhum, Bankura, Midnapore and in all the districts of the Rajshahi Division. Reports from some places are hopeful although the general report is rather discouraging. Seeds will be distributed free during the next year also.

(*b*) **Manures.**—Bonemeal, castor cake and green manuring with dhaincha have already been much appreciated by the cultivators. The practice of using cowpea as a green manure, specially for tobacco, is extending rapidly in Rangpur. During the year 140,000 lbs. of bonemeal, 31,400 lbs. of dhaincha and 4,000 lbs. of cowpea seeds were distributed.

(*c*) **Implements.**—Owing to the efforts of the Department the use of the Don and Chain pump for irrigation, the three-roller sugarcane mill and shallow pan for *gur*-making, the Meston plough and Planet Junior hand-hoe for tillage, are making steady progress.

Exhibitions.

7. In the Western Circle Agricultural Exhibitions were held at Suri (Birbhum), Chinsurah (Hooghly) and Ranjetia (Murshidabad). The usual

Departmental exhibits and demonstrations of *gur*-making, irrigation, cultivation, etc., attracted considerable attention.

Agricultural Associations and Conference.

8. There are Agricultural Associations in all the districts of the Western Circle and in the districts of Rangpur, Bogra and Malda in the Northern Circle. Most of them have done useful work. The Birbhum Agricultural Association deserves special mention. There were two Agricultural Conferences, one at the Burdwan and the other at the Chinsurah Farm. Both were largely attended and the Divisional Commissioner presided on both the occasions.

Acknowledgments.

9. Thanks are due to the administrative officers all over the circles for their kind help and co-operation. The Superintendents of Agriculture and the District Agricultural Officers all deserve commendation for their energy and devotion. The names of Mr. J. N. Chakravarty and Mr. J. N. Sirkar deserve special mention. The former did excellent work in connection with the Rajshahi and Bogra districts flood relief and the latter in connection with the Bankura distress and the organisation of Associations in Birbhum.

R. DAS GUPTA,

Offg. Deputy Director of Agriculture,
Western Circle.

ANNUAL REPORT OF THE SUPERINTENDENT OF AGRICULTURE, PRESIDENCY DIVISION, FOR THE YEAR 1918-19.

I held charge of the division throughout the year and was assisted by a staff of three District Agricultural Officers. I was on tour for 132 days.

Babu Sujyoti Nath Chatterjee, who joined as District Agricultural Officer of Nadia and Murshidabad, on 25th April, with headquarters at Krishnagar, was on tour for 197 days. Babu Dhirendra Nath Das, the officiating District Agricultural Officer, Jessore, was on tour for 44 days, during the period of his service, from July to August, 1918. Mr. P. G. Krishnan, who succeeded him, was on tour for 123 days.

Babu Hiran Kumar Basak, District Agricultural Officer, 24-Parganas, was on tour for 90 days, since his appointment in December, 1918.

Supply of seeds and manures by the Court of Wards' Estates.

As in the previous years, the Court of Wards' estates of Jaunbazar and Gobardanga supplied seeds and manures to the cultivators in those estates for demonstration work, and some direct indents from the tenants of those estates proved the success of demonstration work there.

Demonstration work.

On account of the unfavourable weather conditions throughout the year, the demonstration work in this division, generally speaking, did not give as encouraging results as were noticed in the previous years. Excessive rains during the first part of the year damaged aus paddy, jute and seed-beds of aman paddy in many places. The rainfall during the middle part was

however, favourable, and the surviving plots of aus paddy and jute gave very satisfactory results. Aman paddy also could be resown on seed-beds and transplanted under favourable conditions. It grew well and looked very promising throughout the period of vegetative growth, but the continued drought afterwards proved disastrous to the outturn of grain, excepting in the Sundarban area.

Experts' Selected Seeds.

Kakia Bombai Jute (*C. Capsularis*).—Encouraged by the results obtained in the previous years from the Fibre Expert's *Kakia Bombai* Jute seed, 20 new cultivators tried it in Magrahat (Diamond Harbour Subdivision). But on account of heavy rains, immediately after sowing, many plots were damaged and had to be ploughed up. Six plots, however, survived and gave an increase in yield over that of the local jute. Twenty-two new cultivators in that village have applied to us for that seed and five out of the previous years' batch are ready to purchase it with cash money.

R.26 Jute seed (*selected C. Olitorius*).—Six maunds of selected *Olitorius* jute seed of the Fibre Expert were distributed last year for demonstration. Excepting a few plots that were ploughed up (being entirely damaged by excessive rains immediately after sowing) it has given satisfaction to every cultivator who grew it. The demand for this has increased considerably and arrangements are being made to distribute this year 30 maunds of R.26 jute seed in ¼ lb. packets to enable the cultivators to grow their own seed for the next year. The table below will show the results in some of the plots that were under our immediate supervision :—

Name of the centre.	Subdivision.	Area reduced in bigha.	Number of plots compared in each case.	Calculated outturn per bigha of the demonstration plot.	Calculated outturn per bigha of the check plot.
				Mds. sr. ch.	Mds. sr. ch.
Dandirhat ...	Basirhat ...	3	3	4 11 10	3 0 0
Shibhati ...	Do. ...	1	1	6 0 0	4 0 0
Dandirhat ...	Do. ...	1	1	5 0 0	4 5 0
Basirhat ...	Do. ...	2	2	Entirely damaged.	
Rajnagar ...	Do. ...	7	7	7 6 1	6 32 2
Babanpur ...	Barrackpur ...	1	1	1 15 0	0 25 0
Bongong ...	Bongong ...	9	9	4 0 7	3 19 12
Gotepara ...	Krisnnagar ...	6	4	3 13 5	3 14 5
Nischintapur ...	Meherpur ...	2	1	3 34 0	3 17 12

Indrasail paddy.—Systematic demonstration with Indrasail paddy, in the Presidency Division, began only in 1917, with a view to find out the places where it would be successful. From results obtained that year it was deduced that the tracts comprising the northern and north-eastern portions of 24-Parganas, southern and south-eastern portions of Nadia and the western portion of Jessore would offer the medium water requirements for the introduction of Indrasail paddy. Besides this the shallow-water plots in the northern portion of Diamond Harbour Subdivision and also the fringe area of the Kalantar tract (the basin between the rivers Suti and Jalangi) in the districts of Nadia and Murshidabad would also be benefited by the introduction of Indrasail paddy in years of normal rainfall conditions.

In 1918, 100 maunds of fresh seed of Indrasail paddy were distributed in this division with a view to corroborate the results obtained in 1917. But the prolonged drought, however, of the last Kharif season towards the flowering time, told seriously upon the outturn of paddy crops in general. Indrasail, a late-ripening variety, fared no better than others in point of actual yield in grains, although on account of its tillering habit and luxuriant growth it looked very promising till the end of October. In some cases, however, on low-lying fields in the district of 24-Parganas and Jessore, Indrasail paddy is reported to have fared better than many local varieties.

Some of the results that are shown in the table below tend to prove that Indrasail will be most successful in places where we may get 9 inches to 1 foot of water, excepting the brackish tract :—

Name of the centre.	Subdivision.	Area reduced in bigha.	No. of plots compared in each case.	Calculated outturn per bigha of the demonstration plot.	Calculated outturn per bigha of the check plot.
				Mds. sr. ch.	Mds. sr. ch.
Rajnagar ...	Basirhat ...	4	4	9 2 14	7 39 0
Gobardanga ...	Baraset ...	4	4	6 13 12	5 8 12
Babanpur ...	Barrackpur ...	1	1	3 0 0	2 20 0
Naihati ...	Ditto ...	1	1	3 10 0	2 30 0
Kalopur ...	Bongong ...	3	3	4 31 10	3 20 3
Bongong ...	Ditto ...	8	8	4 12 4	3 13 8
Gotepara ...	Krishnagar ...	4	2	7 0 0	6 17 8
Sonadanga ...	Ditto ...	2	1	6 20 0	4 20 0
Lalbagh ...	Lalbagh ...	½	1	10 0 0	7 20 0

Kataktara Aus Paddy.—Kataktara aus paddy was distributed in the districts of 24-Parganas, Jessore, Nadia and Murshidabad. On account of excessive rainfall, immediately after sowing, many plots in the first two districts were badly damaged. The surviving plots in 24-Parganas district compared favourably with the results obtained from local aus. Bongong plots were too severely damaged to make any comparison possible. In Nadia and Murshidabad, the most important districts for aus paddy, there was no District Agricultural Officer at the time of distributing the seed, and consequently in the majority of the centres, the seed was distributed to cultivators for trial ,through co-operative banks and respectable gentlemen. The reports are very satisfactory, showing yields, in some cases, as high as 11 maunds per bigha. The success in Kushtea is evinced by the fact that the members of the co-operative bank sent indents to purchase 10 maunds of Kataktara aus paddy with cash money. The table below will show the results of some of the plots where Kataktara was actually compared side by side with local aus paddy :—

Name of the centre.	Subdivision.	No. of plots compared in each case.	Area reduced in bigha.	Calculated outturn per bigha of the demonstration plot.	Calculated outturn per bigha of the check plot.
				Mds. sr. ch.	Mds. sr. ch.
Pifa ...	Basirhat ...	1	1	7 10 0	3 22 0
Shibhati ...	Ditto ...	1	1	4 0 0	2 0 0
Dandirhat ...	Ditto ...	1	1	6 10 0	5 5 0
Rajnagar ...	Ditto ...	5	5	7 2 6	6 4 6
Bongong ...	Bongong ...	1	1	3 10 0	5 0 0
Ditto ...	Ditto ...	3	3	3 10 0	Entirely damaged by excessive rains.
Gotepara ...	Krishnagar ...	1	1-5	2 30 0	2 25 0
Nischintapur ...	Meherpur ...	1	1	8 0 0	Yield of the check plot was not reported.

Nagra paddy.—Thirty maunds of Nagra paddy were distributed in 17 centres, for trial, last year. But on account of unfavourable rainfall conditions no definite conclusion could be arrived at. In a few places, however, the results obtained showed greater yield than some of the local varieties, as will be seen from the table below :—

Name of the centre.	Subdivision.	No. of plots compared in each case.	Area reduced in bigha.	Calculated outturn per bigha of the demonstration plot.	Calculated outturn per bigha of the check plot.
				Mds. sr. ch.	Mds. sr. ch.
Babanpur ...	Barrackpur ...	2	2	2 27 8	2 7 8
Naihati ...	Ditto ...	1	1	2 30 0	2 0 0
Rajnagar ...	Basirhat ...	1	1	7 0 0	6 20 0
Kalopur ...	Bongong ...	1	1	5 19 0	3 10 8
Bongong ...	Ditto ...	7	7	4 33 2	4 8 1
Arjanagar ...	Krishnagar ...	1	2	3 28 8	4 38 0

Application of manures.

Bonemeal.—About 23 maunds (1,886 lbs.) of bonemeal were sold to cultivators, who used it on aman paddy lands, but no definite conclusions could be arrived at on account of failure of aman paddy. This manure however is not important for the Presidency Division, excepting the Rarh tract, the western portion of the Murshidabad district, where its use is gradually spreading.

Castor cake.—In the eastern part of Murshidabad, as well as in other districts, castor cake is becoming popular as a general manure for almost all the important crops.

About 246 maunds (about 9 tons) of castor cake were sold during the year under report. Its effect on sugarcane proved very satisfactory. B. 147 canes, manured with castor cake, at the rate of 6 maunds per bigha, sent by Babu Tarak Das Banerjee of Ghoshpur (24-Parganas) to the Victory Mela Exhibition, attracted the attention of every visitor. The potato plots manured with castor cake seem to be very promising.

Dhaincha (*Sesbania aculeata*).—Green manuring was tried on about 250 bighas of aman paddy land, but on account of the failure of aman paddy no effect could be noticed during the year under review.

Superphosphate—Was tried on sugar cane in several places. From the growth of the canes it did not seem to be discouraging, but it would be necessary to establish its value by actual results, in comparison with castor cake under normal price. The results have not reached us as yet.

Demonstration of Implements.

During the year under report one Chain pump (hand power) and a three roller sugarcane crushing mill have been issued from this seed store for demonstration purpose in Debagram (Nadia) and Ghoshpur (24-Parganas), respectively. At Chuadanga, in Nadia, Babu Bhujendra Nath Banerjee has installed a bullock-gear Chain pump, which was purchased by him for Rs. 500 (pre-war price Rs. 250) from Messrs. Burn & Co., Howrah. The pump arrived there very late in the season and no definite idea could be formed about its actual merit and capacity from last year's working. The working of the pump is being closely observed, and if it proves economically successful its introduction may be considered as the greatest boon to the cultivators in Western Bengal, particularly in districts like Nadia and Murshidabad, where crops suffer from drought too frequently. The question of cost will not be of much consequence if it is introduced through co-operative organisations and used by several cultivators jointly.

The use of Dons and Planet Junior hand-hoes, considered to be economical in previous years, did not show any progress last year on account of the abnormally high price of the articles.

Introduction of new crops and better varieties of existing crops.

Groundnut.—In tracts where lifting of groundnut will not be difficult, this crop has a reasonable chance of success. In the Presidency Division, the districts of Nadia and Murshidabad and also a part of Bongong Subdivision, may be considerably benefited by the introduction of groundnut as an oil crop. A large area of typical groundnut land is now lying practically waste, as the cultivation of aus paddy or other Kharif crops is not considered economical on account of poor returns. Twenty-eight maunds of groundnuts were distributed last year to cultivators in this division. But on account of untoward circumstances very indifferent results were obtained in the majority of places. The yield obtained in some places, however, attracted the attention of the neighbouring cultivators, and they were convinced that growing groundnut would be an easy way of profitably cultivating the sandy lands. One Arich Mullick of Bethuadahari got 6 maunds 10 seers of nuts from one bigha of land, which would mean a gross receipt of Rs. 62-8, at the current price of groundnut. Besides the price of nuts, the foliage immediately before the harvest was tried and proved successful as cattle food.

Sugarcane.—Thick varieties of sugarcane proved very successful last year in several places in the district of 24-Parganas. The canes grown in Ghoshpur measured from 16 to 18 feet without the tops. The demand for sugarcane cuttings has enormously increased, and the supplying capacity of the Chinsurah Farm was far too low. About 30,000 cuttings of some of the best varieties were supplied in this division in small quantities (250 to each cultivator) to introduce them in different places. The area under sugarcane may expand very considerably if the question of irrigation is properly attended to.

Agricultural Associations.

To the credit of the newly appointed District Agricultural Officers, noticeable activity is being shewn by the members of the District Agricultural Associations. The Agricultural Officers have kept themselves in close touch with the members and many of them have given proof of their hearty co-operation with us; but an adequate number of demonstrators are necessary to push on the work. The Agricultural Association of Murshidabad has recently appointed a demonstrator for one year on Rs. 25 per mensem and allotted Rs. 234 for demonstration work. The District Agricultural Association of Jessore spent about Rs. 100 for demonstration of Darjeeling potato and set apart Rs. 250 for cotton cultivation in 1919, provided some cultivators recommended by the members of the Association would come forward to grow cotton.

Exhibition.

During the year under report there was only one Agricultural Exhibition in this division, at Banjetia, in the district of Murshidabad. Elaborate arrangements were made for demonstration of implements for cultivation, as well as irrigation appliances, which was the special point of attraction, to all persons interested in agriculture. *Gur*-making by the Farm Superintendent, Chinsurah, and groundnut oil pressing by the District Agricultural Officer, Birbhum, were very largely attended to. There was also a good show of departmental exhibits of different kinds of selected seeds, as well as grains, fibres, sugarcane cuttings, etc.

Seed-store.

During the year under report the seed store for the Presidency Division was at 27, Upper Circular Road, Calcutta, as in the previous years. The increased number of actual cultivators that visited this seed store indicated the popularity of the seed store.

Fairly large quantities of seeds and manures were supplied through this seed store. The demand for seeds and manures from the members of the Co-operative Credit Societies was encouraging.

Supply of seeds and manures through this seed store were as follows :—

FOR DEMONSTRATION WORK.

Article.	Quantity.					
	Mds.	srs.	ch.	Tons.	cwt.	lbs.
Indrasail paddy	97	14	0	3	11	30
Nagra paddy	30	0	0	1	1	108
Kataktara aus paddy	50	0	0	1	16	68
Cotton seed	31	25	0	1	3	17
R.26 Jute seed	29	31	0	1	1	89
Kakya Bombai Jute seed ...	0	11	0	0	0	22
Groundnuts	25	0	0	0	18	34
Superphosphate	1	0	0	0	0	82

SOLD FOR THE PURPOSE OF CULTIVATION.

Indrasail paddy	4	26	0	0	3	45
Dadkhani paddy	0	20	0	0	0	41
Samudrabali paddy	0	20	0	0	0	41
Aus paddy	1	5	0	0	0	92
Mung	1	5	0	0	0	92
Jowar seed	0	5	0	0	0	10
Niger seed	0	5	0	0	0	10
Groundnuts	3	10	0	0	2	42
Rahar seed	6	0	0	0	4	44
Linseed	5	20	0	0	4	3
Deshi Jute seed	0	17	8	0	0	35
Kakia Bombai Jute seed ...	1	28	0	0	1	27
Nainital potato	11	20	0	0	8	47
Darjeeling potato	40	0	0	1	9	32
Cotton seed	28	35	0	1	1	15
Turmeric bulbs	2	0	0	0	1	52
Dhaincha seed	49	15	0	1	16	16
Papya seed	56½ tolas			22½ oz.		
Bonemeal	29	10	0	1	1	46
Superphosphate	15	29	0	0	11	56
Castor cake	292	28	0	10	14	33
Mohua cake	95	31	0	3	10	13

A statement showing the assets and liabilities of the store is appended to this report.

Acknowledgments.

We are grateful to the Collectors, Subdivisional Officers, as well as other executive officers, and also to the members of the Agricultural Associations and the managers of the Janbazar and Gobardanga Wards' Estates, for their valuable assistance. The hearty co-operation of the Secretaries of the Central Co-operative Banks made the difficult work of winning over the cultivators' confidence considerably easy, and I must make special mention of the lively interest taken in this connection by Rai Nitya Charan Nag Bahadur of Berhampur Central Bank, Rai Indu Bhusan Bhaduri Bahadur and Babu Manindra Nath Chatterjee of the Krishnagar Central Bank and Babu Dakshina Ranjan Acharjee of Kustea Central Bank.

H. P. MITRA,

Superintendent of Agriculture,

Presidency Division.

Statement showing Assets and Liabilities of the Presidency Divisional Seed-store for the year 1918-19.

ASSETS.			LIABILITIES.		
Items.	Amount.	Amount.	Items.	Amount.	Amount.
	Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.
Total amount in cash realised from sale in year under report.	3,701 6 6		Rent	1,170 0 0	
			Establishment ...	480 0 0	
Deduct outstanding of last year realised in year under report.	1,375 2 3				
			Office contingency ...	392 13 9	
Cash-receipts of current year.	...	2,326 4 3	Total office expenses ...	...	2,042 13 9
			Depreciation on materials for storing.	...	30 0 0
Bills outstanding on account of Presidency Divisional Seeds-store contingency.	1,604 7 6		Packing and freight charges.	571 13 6	
Deduct bills outstanding issued before 1st April 1918.	894 3 9		*Deduct* packing and freight charges over articles sent for demonstration work.	69 2 9	
Non-realisable for bills of cotton seeds, etc.	117 4 0		Packing and freight charges over articles sold.	...	502 10 9
Bills outstanding, but not overdue.	...	592 15 9	*Cost price of stores purchased during the year.	2,046 12 6	
Total sale-proceeds during the year.	...	2,919 4 0	*Deduct* cost price of 11 maunds 22½ seers of cotton seed for distribution.	83 13 3	
			Cost price of saleable articles purchased during the year.	...	1,962 15 3
			Cost price of stock in hand on 1st April 1918.	708 14 0	
			Cost price of stock in hand on 31st March 1919.	369 13 3	
			Decrease in stock ...	...	339 0 9
			Total ...	...	4,877 8 6
			Profit and loss account	...	1,958 4 6
					2,919 4 0

* Bill paid in 1918-19 Rs. 1,954-12-6 ; bills payable in 1919-20 Rs. 92.

	Rs. A. P.	Rs. A. P.
N.B.—Total sale-proceeds during the year	2,919 4 0	
Deduct the amount for the paddy seedlings supplied for Bogra Flood Relief work, in which no profit was charged	425 4 0	
Sale-proceeds from private parties	...	2,494 0 0
Total expenditure as actual cost over seeds, manures, etc., for sale ...	2,804 10 9	
Expenditure for paddy seedling	425 4 0	
Expenditure over seeds, etc., supplied to private parties	...	2,379 6 9
Actual profit charged over the quantities sold		114 9 3, *i.e.*, 4·8 per cent. over the actual cost.

ANNUAL REPORT OF THE SUPERINTENDENT OF AGRICULTURE, BURDWAN DIVISION, FOR THE YEAR 1918-19.

Staff.

In the beginning of the year there were District Agricultural Officers only in the districts of Bankura, Birbhum and Midnapore. But since December last Burdwan and Hooghly have also got District Agricultural Officers. Towards the close of the year a District Agricultural Officer was sanctioned for Howrah. In addition to the permanent staff, two Agricultural Officers were also temporarily employed for the organisation work in Birbhum District for a year.

Two other Agricultural Officers appointed by the District Boards of Midnapore and Hooghly are also working under us. The number of demonstrators in the division was ten, maintained by Department, four by the Midnapore District Board and one from the Birbhum District Board. There were by two other demonstrators in the district of Midnapore—one for the Nayabasan Court of Wards' Estate and another for Boinchi B. L. Mukerjee's Trust Estate.

The work already undertaken seems to be so heavy for the present staff that it is absolutely necessary now to increase the number of demonstrators in each district of the division.

Four temporary hands were engaged in Bankura for two months in order to arrange and supervise cotton cultivation.

Thirteen jute clerks, as usual, were appointed this year for jute forecast work.

The number of days I was out on tour, in the year, is 242.

Demonstrations—1. Aman paddy with—

A.—Bonemeal.

B.—Dhaincha green-manure.

These two manures, like castor cake and conserved cowdung, are so much appreciated by the cultivators of this division that many cultivators have already commenced to have bonemeal direct from European firms and grow Dhaincha for seed purpose in their own lands. The supply of these things from our store is also increasing very much day by day. District Seed stores are being started and we have already got stores in Birbhum, Bankura and Burdwan.

The year under report was very bad for agriculture; yet good results were obtained from the above two manures in places where there was no want of moisture on soil in autumn. About the good results of bonemeal and Dhaincha the District Agricultural Officer, Bankura, writes: "Bonemeal or Dhaincha green-manure does not only produce increases in outturn, but is an economic success and either can be used, without least hesitation".

The demand for bonemeal from Birbhum was so great last year that we could supply only half the quatity, owing to insufficient accommodation in railway.

Varieties of paddy.

2. The special varieties tried are Indrasail and Nagra (*Aman*) and Kataktara (*Aus*).

All these, in suitable lands, gave better outturn than the ordinary local varieties of high yields. Regarding Indrasail and Nagra, Babu Bhabotosh Dutt, District Agricultural Officer, Midnapore, says: "Indrasail and Nagra paddies grown on medium elevation, where there was no water in the fields, due to drought in September, both being late ripening varieties, did not give

good outturns as in previous year, but those grown on lower elevation gave exceptionally good outturns in comparison with local paddy".

Only a small quantity of Kataktara seed was distributed in this division. Everywhere it gave better outturns than the local varieties of *Aus*. The heavy demand for seeds from the districts, amounting to a thousand maunds, viz., Bankura 250, Midnapore 250, Birbhum 250, Burdwan 150, Hooghly 75, Howrah 25, will show how the cultivators appreciate the variety.

The area under paddy in Birbhum, Bankura and Midnapore, under our supervision, is given below :—

	Area in bighas.		
	Birbhum.	Bankura.	Midnapore.
(*a*) With bonemeal	1,890	109	53.
(*b*) With Dhaincha green-manure	910	256	293
(*c*) Indrasail	112	60	584
(*d*) Nagra	46	80	240
(*e*) Kataktara	...	10	10

Groundnut.—It is an important crop for sandy and high-lands, now lying waste in the districts of Birbhum, Bankura, Midnapore and the Asansol subdivision of Burdwan. The area under cultivation is gradually increasing every year. A very little quantity of seed is now supplied to the cultivators from the Divisional Store. The locally grown crop is now used as seeds. Though the area under cultivation, in touch with us, is more than a thousand bighas, we supplied only 5,000 lbs. of groundnut seed to the parties. Report reaches us that lands lying waste from time immemorial are being taken on lease by cultivators from zamindars in Birbhum for the cultivation of ground nuts.

Owing to drought in September and October, the outturn was poor this year. The average outturn per bigha comes down to 5 maunds, from 8 maunds in the district of Midnapore. But the loss is compensated for by the high price of Rs. 12 per maund, instead of the usual rate of Rs. 7.

Difficulties have been felt in many cases in raising the crop where the cultivators did not mind harvesting it just in time. The crop is to be sown in the month of May and harvested in October by ploughing, when there is some moisture in the soil. Another remedy to get rid of this difficulty is to grow the early varieties, which are also being tried in this division.

Sugarcane.—Mauritius Tana is surpassing all other varieties of sugarcanes in the division. Last year more than 50,000 cuttings were distributed in the division, of which 30,000 were grown in Birbhum alone. The Collector and the President, District Agricultural Association, Birbhum, observes in his Annual Report—" It is worth mentioning here that most gratifying results have been obtained from the cultivation of Tana Mauritius sugarcane during the last year. The Mauritius sugarcane at Bolpur, Bongram and Nanur attained a height of 14½ feet. Babu Adhar Chandra Roy, Secretary of the Bolpur Branch Association, reports that these giant sugarcanes in the Bolpur fields are visited every week on *hât* days by hundreds of cultivators, to whom it serves as a great object lesson in the improvement of agriculture."

The Tana cane cuttings available in Bolpur centre have been sold by the cultivators at double the price of the local varieties.

About a lakh of sets of these popular canes have been distributed among the *bona fide* cultivators this year, each getting 250. It is thus hoped that its propagation won't take much time.

Cotton.—11,600 lbs. seed of cotton, specially of the Dharwar variety, (American acclimatised) was supplied from this Divisional Store. Though the season was not favourable this year for cotton cultivation, it did tolerably well in some places in the district of Birbhum, Bankura and Midnapore. The highest outturn per bigha is 240 lbs. with seed.

Potatoes.—Though Hooghly and Burdwan, I believe, head the list of other districts in potato cultivation, Birbhum, Bankura and Midnapore, are making great progress in this direction during the last few years. Our officers are showing the methods of preparing the soil, application of manures,

specially of castor cake and the use of the narrow potato-kodali. There is a great demand of this spade in Birbhum. Other crops tried on a small scale are :—

Pusa wheat No. 12 ; Matihari and Hingli tobacco ; Sonamug ; Jute R.26 and Ceylon Papaya. The Ceylon papaya is a very popular thing in this division.

Implements.—Don and chain pump for irrigation, three-roller crushing mill and shallow pans for *gur*-making, Planet Junior hand-hoe and Meston plough for tillage, were gaining in popularity in the division, very rapidly. But owing to the prohibitive price of iron goods these days the progress is rather retarded.

Associations.—There is a Divisional Agricultural Association and the Divisional Commissioner is its President. Mr. Lees, the present Commissioner, takes special interest in agriculture. On many occasions he took active part in the agricultural deliberations, even in some District Agricultural meetings. The Divisional Association of the present day does practically stand as a prominent body to ascertain the steps for the improvement of agriculture in the various districts of the division.

Every district of the division has got a District Agricultural Association, with the District Magistrate as its President. The progress of association work in the district of Birbhum is marvellous. In the last annual meeting of the Birbhum Agricultural Association the Hon'ble Mr. J. G. Cumming, C.S.I., C.I.E., I.C.S., Executive Member, remarked : "In matters of Agricultural Associations Birbhum leads other districts of Bengal."

The work of the Birbhum District Agricultural Association has developed so much that it has been found necessary to start some branch associations in order to manage the work satisfactorily. The President wanted a scheme from me, which was duly submitted. It is most gratifying to report that the number of the Branch Associations in Birbhum rose to thirty during this short period of nine months. The number of members of these associations is now about 1,500. Thus the work of the Central Agricultural Association was decentralised and expanded ; hundreds of agriculturists in the district could thus get a chance of adopting practical demonstrations of new crops, new varieties, and new manures. The example set by Mr. G. S. Dutt, I.C.S., the present Collector and President of the District Agricultural Association of Birbhum, in introducing improved methods of agriculture in our country, will undoubtedly give an opportunity to other Presidents to set to work with a view to bring their associations into touch with the great body of agriculturists of their districts. Besides the Branch Agricultural Associations, Birbhum has got a Sub-district Agricultural Association at Rampurhat.

The Birbhum Agricultural Association has already started a quarterly agricultural organ called *Bhumi Lakshmi*. Next to Birbhum, the Bankura District Agricultural Association has developed a great deal. There are about 500 members of the association and recently it has been decided to have two Sub-district Associations, one at each Subdivision of Bankura. This District Association has been publishing an Annual Agricultural Calendar since last year.

The united efforts of agricultural and executive officers and of the local influential people have helped us much in discharging our duties in the districts.

The local Agricultural officers attended the Branch and District Agricultural Association meetings, held occasionally during the year. With the exception of a few I attended almost all the meetings of the District Agricultural Associations in the division.

The meeting of the Divisional Agricultural Association, held on the 19th February, at Chinsurah, was attended by the Deputy Director of Agriculture Western Circle, myself and the District Agricultural Officers of Midnapur Bankura, Burdwan and Birbhum.

In the year under review here were two Agricultural conferences, one at the Chinsurah Farm and the other at the Burdwan Farm. The Divisional Commissioner presided on both the occasions.

Exhibition.—There were several village shows in some places of Birbhum, where agricultural demonstrations were done by our officers. The most

important exhibitions held during the year were those at Suri and Chinsurah. At the former, practical demonstrations on the cultivation of potato, groundnut, sugarcane, patal and green-manuring with Dhaincha, were shown by growing them in the *mela* premises by Babu Santosh Behari Bose, District Agricultural Officer, Birbhum. Groundnut oil was extracted there by a press manufactured locally. Exhibits from the Department, as well as from the association members, drew the attention of thousands of cultivators daily.

The Departmental stall at the Chinsurah Exhibition was in charge of Babu Chuni Lal Mustafi, Superintendent of the Chinsurah Farm, who explained to the big assembly daily, during the *mela* period, the improved varieties of crops, manures and *gur* manufacturing. In both the *melas* lectures were delivered by me with slides.

Seed-store.—The work of the store has practically doubled during the year. It is satisfactory to report, however, that groundnut, sugarcane and Dhaincha seeds were in many cases supplied locally from the crop introduced by us; and bonemeal was in some cases obtained by the parties direct from some European firms of Calcutta. The quantities of seeds and manures which were supplied in various districts of the division are noted below :—

	lbs.
Dhaincha seed	26,400
Cotton seed	11,600
Groundnut seed	5,000
Indrasail paddy seed	8,000
Other seeds (wheat, pulses, etc.)	3,356
Castor-cake	19,360
Bonemeal	129,600
Sugarcane cuttings of foreign varieties	100,000

A statement showing the assets and liabilities, of the store is appended to this report.

Other works.—At the instance of the Economic Botanist, samples of seeds of different varieties of paddy, grown in the districts of Howrah and Hooghly, were collected with the help of two temporary hands.

J. N. SIRKAR,

Superintendent of Agriculture, Burdwan Division.

Statement of Assets and Liabilities of the Burdwan Divisional Seed-store for 1918-19.

Assets or receipts.

	Rs.	A.	P.
Total amount in cash realised from sale in year under report ...	4,234	5	3
Deduct outstanding of last year realised in year under report ...	1,009	8	0
Cash receipts of current year ...	3,224	13	3
Bills outstanding	1,793	5	6
Deduct on account of bad debts non-realisable and written-off ...	*Nil.*		
Total sale-proceeds	5,018	2	9

Liabilities or charges.

	Rs.	A.	P.	Rs.	A.	P.
Rent	840	0	0			
Deduct on account of rent for the office of the Superintendent of Agriculture Rs. 35 ...	420	0	0			
				4	0	0
Establishment				509	8	9
Contingencies ...	499	14	6			
Deduct cost of postage service stamps in connection with demonstration work ...	60	0	0			
Deduct cost of bags purchased in connection with demonstration work	50	0	0			
				389	14	6
Depreciation on materials for storing at 1 per cent. of cost price.... ...	...			45	0	0
Packing and freight charges ...	649	4	9			
Deduct packing and freight charges of cotton seeds for demonstration ...	135	14	0			
Deduct. packing and freight charges for jute	21	4	9			
				492	2	9
Cost of purchasing stores ...	4,488	7	9			
Deduct price of potato seeds paid to Superintendent of Agriculture, Dacca, which was purchased, supplied and billed for last year	103	8	0			
				4,384	15	9
Cost price of stock in hand on 1st April 1918	1,063	5	0			
Cost price of stock in hand on 31st March 1919	1,567	7	9			
Increase ...	504	2	9			
Deduct increase in stock				504	2	9
				5,737	7	0
Profit and loss account				719	4	3
Total ...				5,018	2	9

	Rs.	A.	P.
° Amount of bills outstanding overdue	522	0	3
" " " not overdue	1,271	5	3
Total ...	1,793	5	6

ANNUAL REPORT OF THE SUPERINTENDENT OF AGRICULTURE, RAJSHAHI DIVISION, FOR THE YEAR 1918-19.

Dr. N. Gupta was in charge of the division up to the 30th June, when I took over charge.

The year under review was one of rapid expansion. With the exception of Darjeeling, an Agricultural Officer was posted to each of the seven districts. To cope with the distribution of the Kakya Bombai Jute seeds and Indrasail paddy three additional temporary Agricultural overseers were also sanctioned for the subdivisions of Shirajganj, Alipur-Duars and Kurigram. The lower subordinate staff consisted of 12 demonstrators and 25 temporary men and three demonstrators sanctioned by the Court of Wards and the District Boards, also worked under the supervision of the Departmental officers. The staff were rearranged during the year, so that there is now at least one demonstrator in each of the district headquarters. It is very difficult, however, to keep pace with the rapid expansion of the Departmental activities without largely increasing their number. It is urgently necessary to have immediately at least one demonstrator in each of the subdivisional headquarters.

The District Agricultural Officers were posted as follows :—

Malda	...	Babu Binode Lal Mukherjee, B. Ag.
Rajshahi	...	,, Charu Chandra Sanyal, L. Ag.
Pabna	...	,, H. K. Guha (on leave), Babu Dinesh Chandra Das (officiating).
Bogra	...	,, Jogesh Chandra Ray, L. Ag.
Rangpur	...	,, Mohini Mohan Ghosh.
Jalpaiguri	...	,, Digendra Nath Banerjee.
Dinajpur	...	,, Promotha Nath Sen Gupta, L. Ag.

Tours.—Dr. Gupta spent 50 days on tour. I was on tour for 180 days and visited the following important places :—

Calcutta, Dacca, Rangpur, Rajshahi, Jalpaiguri, Dinajpur, Pabna, Bogra, Nator, Santahar, Parvatipur, Naogaon, Shirajganj, Silliguri, Iswardi. Hilli, Raiganj, Bharanga, Nilphamari Chatmohar, Pakshi, Raninagar, Burirhat, Lalmonirhat and Gaibandha

I attended the Conference of the Co-operative Credit Societies at Calcutta and the Social Service exhibition at Dacca.

The number of days the District Agricultural Officers were on tour and the important places visited by them are noted below :—

Name ...	No. of days on tour.		Places visited.
District Agricultural Officer, Rangpur	134	...	Gaibandha, Kurigram, Nilphamari, Mohimaganj, Fulchari, Lalmonirhat, Tushbhander, Hatibhanda, Ulipur, Chilmari, Saidpur, Domer and Dimla.
District Agricultural Officer, Bogra	214	...	Khanjanpur, Jamalganj, Santahar, Jaypurhat, Nasaratpur, Talora, Champapur, Paikor, Kahalu, Sherpur, Dhibal, Shariakandi, Gavtoli, Shibganj, Sonatola and Fulbari.
District Agricultural Officer, Pabna	225	...	Shirajganj, Bharanga, Gopalnagar, Chandpur, Shujanagar, Bera, Iswardi, and Saithia.
District Agricultural Officer, Malda	174	...	Dacca, Jalpaiguri, Santahar, Berhampur, Rangpur, Rajshahi, Chanchal and Harishchandrapur.
District Agricultural Officer, Dinajpur	266	...	Thakurgaon, Balurghat, Rayganj, Bahir, Birganj, Birol, Chiribandar, Durgapur, Habra, Ulipur, Samjhiya, Nargun, Nayabandar, etc. Besides attended at Dacca, Jalpaiguri, Rajshahi and Rangpur.
District Agricultural Officer, Jalpaiguri	193	...	Siliguri, Belakoba, Rajganj, Mandalghat, Debiganj, Patgram, Bawra, Maynaguri Falakata, Madarihat, Alipur Duars, Bholka, Dacca and Rajshahi.
District Agricultural Officer, Rajshahi	220	...	Naogaon, Biria, Kaliganj, Balihar, Dubalhati, Badalgachi, Shibanpur, Banda, Niamatpur, Raninagar, Shaimpur, Ratmall, Bilmoria, Charghat, Putia, Godagari, Nator.

The work done may be divided under the three following heads :—

(*i*) Distribution of improved seeds raised by the experts at Dacca.
(*ii*) Distribution of rabi seeds.
(*iii*) Demonstrations of manures, implements, etc.

Distribution of improved seeds.—The two following statements show the quantity of Kakya Bombai jute seeds and Indrasail paddy distributed in the districts during the last season, with particulars about the results.

Indrasail Paddy.

Districts.	Quantity.	No. of people.	No. of thanas.	No. of unions.	Percentage of people who kept seed.
	lbs.				Per cent.
Jalpaiguri	8,200	565	8	18	95
Rangpur	50,659	4,368	18	52	95
Bogra	50,733	..	10	30	40
Pabna	3,618	292	5	12	...
Rajshahi	22,457	998	7	...	50
Malda	4,510	387	9	16	62
Dinajpur	6,560	498	4	15	70

Kakya Bombai Jute.

Districts.	Quantity in lbs.	No. of people.	No. of thanas.	No. of unions.	Percentage of people who kept seed.	Premium over the local jute.
	lbs.				Per cent.	
Jalpaiguri	1,640	338	7	30	37	*Nil.*
Rangpur	11,608	32,169	19	93	58	Re. 1 to Rs. 3 per maund.
Bogra	6,560	25 000	11	40	74·6	*Nil.*
Pabna	1,640	2,108	7	19	None	Re. 1 to Re. 1-8 per maund.
Rajshahi	51	70	...	...	40	*Nil.*
Malda	1 386	2,643	8	23	50	As. 10 to Rs. 2 per maund.
Dinajpur	40	1,085	20	33	51	*Nil.*

In most places the Kakya Bombai jute and the Indrasail paddy proved their superiority over the local varieties. The Kakya Bombai jute gave an increased outturn of 128 to 738 lbs. per acre over the local jute, the average working out to 300 lbs. per acre. The seeds were distributed in ¼-lb. packets and each cultivator was allowed only enough to produce sufficient seeds for his next year's sowing. In localities where the Kakya Bombai jute was being tried for the first time, the cultivators were allowed to cut a small part of their crop as tests. On account of the high price of jute some cultivators in other districts also could not resist the temptation of cutting a part of the crop as fibre. But the proportion of those who kept seed exceeded 50 per cent.

The paddy seeds which were supplied last year have been recovered during the present harvest. On account of the flood in the districts of Rajshahi, Bogra and Pabna, followed by the subsequent severe drought, the paddy crop was seriously damaged, and it has not been possible to recover any considerable proportion of the seed. In other districts, however, there has been little difficulty in recovering the seeds. In Rangpur, for instance, the whole of 640 maunds has been recovered without any difficulty.

During the present season arrangements have been made to distribute the following quantities of jute and paddy seeds :—

Name of districts.	Kakya Bombai jute in maunds.	Indrasail paddy in maunds.
Rajshahi	100	700
Rangpur	100	600
Bogra	30	550
Pabna	70	100
Dinajpur	25	200
Malda	20	150
Jalpaiguri	30	200
Total ...	375	2,500

Except in the flooded area none of the cultivators who were given seeds last year will be given any seed again. Arrangements have been made to sell small quantities of seeds where the demand is very great, but the demand for seed is much greater than the supply, specially of jute.

The Indrasail gave an increased outturn of 500 to 1,000 lbs. per acre over the local varieties in the different districts, the average working out to 700 lbs.

Distribution of rabi seeds.

The most important work done in the division during the year was perhaps the distribution of rabi seeds in the flooded area of the Bogra and Rajshahi districts. A very large area in both the districts was completely flooded and paddy, the main crop of the area, was largely destroyed. Steps were taken to supply paddy seedlings in the places where there was yet any chance of transplanting. As, however, the flood occurred very late in August and the seedlings had to be transported from great distances the cost was very high, and the area which could be helped in this way was very small. A careful enquiry was made as to the chances of helping cultivators in putting a large area under rabi crop and it was found that the main difficulty was in the supply of enough seeds at a reasonable cost. At the suggestion of the Director of Agriculture it was decided to issue seeds as loan. The preliminary enquiry as to how much seed is required took some time and as the flood occurred shortly before the rabi season the seeds had to be arranged in a great hurry.

The seeds were purchased by the Department of Agriculture and issued by the respective Collectors of Rajshahi and Bogra as loan to individual cultivators, and the actual distribution done through the Departmental Officers. Twelve temporary stores were started for the purpose and a special staff sanctioned. The stores were visited by the Hon'ble Mr. J. G. Cumming, the Divisional Commissioner, the Director of Agriculture, the Collectors of Rajshahi and Bogra, and by the Deputy Director of Agriculture. The following table gives particulars regarding the distribution :—

Commodities.	Total quantity of seeds issued in Rajshahi and Bogra.	Total area sown in acres (estimated).
	Md. s. ch.	
Kheshari (*Lathirus Sativus*) ...	475 9 11	1,200
Lentils (*Lens Esculenta*).	558 24 0	2,065
Gram (*Cicer Arictinum*)	385 27 9	668
Linseed (*Linum Usitatissinum*) ...	590 9 15	2,698
Mustard (*Brassica*)	652 1 13	4,087
Wheat (*Triticum Vulgare*)	508 5 15	1,016
Total		11,734

The result of very careful enquiries subsequently made showed that the seeds were actually used for sowing.

Although on account of the subsequent drought the crop did not do as well as might be expected, the total value of the crop from this area can be estimated at over Rs. 4 lakhs, but for the timely supply of the seeds most of this area would have remained fallow and the distress would have been much more as the paddy crop failed entirely in this area. The experience gained in this work showed that, if a timely supply of seeds of rabi crops can be provided at a reasonable cost, a much larger quantity can be expected to be sown than is usually the case.

Our thanks are due to the Collectors of Bogra and Rajshahi, the Subdivisional Officers of Naogaon, Natór and the Revenue Officers, who were deputed to issue the seed loan, for the active assistance received.

Demonstrations.

The main items in this division were :—

(1) The cultivation of hill potatoes.
(2) The growing of Sumatra tobacco around Burirhat.

Hill Potatoes.

In the northern districts of this division the Darjeeling potatoes do not keep very well and the people prefer the taste of the local potato; the demand for the Darjeeling potato is, therefore, rather limited. In the southern districts, however, specially in Pabna, the demand is steadily increasing. The Co-operative Credit Societies purchased 200 maunds of potatoes for the district alone. Besides 276 maunds of Darjeeling potatoes and 60 maunds of Nainital potatoes were purchased through the Department for the rest of the division. Darjeeling potatoes, on an average, gave an outturn of 100 to 150 maunds without irrigation, whereas Nainital gave 60 to 100 maunds and country potatoes 50 to 75 maunds per acre.

Sumatra Tobacco.

In Rangpur the cultivation of Sumatra tobacco has increased very considerably around the Burirhat Farm and in some other parts of the district also. Last year three acres were grown round about the farm. Then new curing sheds were erected by Co-operative Credit Societies and a few cultivators cured their tobacco in their own sheds. The curing sheds were put up by the Agricultural Association. The cost of the curing sheds has been almost wholly recovered from the sale of last year's produce. Encouraged by the very high prices of last year, a large number of ryots have put down small patches of Sumatra tobacco and about 20 acres is being grown this season.

A small inexpensive shed which would accommodate the outturn of about a bigha was devised by the Director of Agriculture and put up at the Burirhat Farm. The tobacco, cured in this shed, proved quite successful and a few more sheds are being put up this year on the farm. Should they prove successful, as there is every chance of their doing, the difficulty of the joint ownership of the curing sheds would be practically solved. A few ryots have already erected curing sheds of this type themselves. There is a danger, however, of the business falling in the hands of the *dalals* or middlemen. As a matter of fact, a few cultivators are already known to have taken advances from the *dalals*, having hypothecated their tobacco. There is also the danger of the quality deteriorating unless the whole process of the cultivation and curing is closely supervised by expert cultivators. It will, therefore, be necessary for the Department, the Co-operative Credit Societies and the Agricultural Association to exercise a very close supervision over the whole process, at least for some time to come yet.

A very remarkable result of the growing of Sumatra tobacco has been perhaps the starting of a private agricultural company, which has started a farm where they propose to grow Sumatra tobacco on a large scale, and to keep cows for supplying the people of the town with milk. They are arranging with the Town Municipality to take the sweepings of the town as well as the litter of the stables to provide manure.

Cotton.

Small quantities of Dharwar cotton were supplied in all the districts. On account of the late arrival of the seed last year and the unfavourable weather conditions during sowing season, the results were not very encouraging. They have, however, done fairly well in a few places in Malda and Rajshahi.

Manures.

The practice of green-manuring, specially for tobacco, is extending; 4,000 lbs. of cowpea were sown last year, and the demand for the coming year is expected to exceed 10,000 lbs. 1,000 lbs. of Dhaincha was sold or distributed. On account of the heavy rain immediately after sowing, the growth in most of the places was, however, very poor.

Seed-stores.

District Seed-stores were started in each of the districts during the year, although the accounts were kept at the Divisional Seed-store. The following seeds, manures, etc., were supplied during the year :—

Bonemeal ...	..	...	...	100 maunds.
Iron ploughs	...	...	...	100 (Nos.)
Dhaincha ...	...	...	...	1,000 lbs.
Cowpea ...	...	...	...	4,000 „

A statement showing the assets and liabilities of the Divisional Store is appended to this report.

The scheme of starting rural seed-stores has made considerable progress during the year. Four seed-stores are being constructed in the four Khash-mahal tahsils of the Alipur-Duars and Jalpaiguri, viz., Alipur-Duars (Sadar), Falakata, Mainaguri and Bholka. One store is being put up by the Court of Wards at Rayganj (Dinajpur). The District Board of Pabna has agreed to put up a seed-store at Serajganj. A seed-store is being put up at Nilphamari by the Rangpur Agricultural Association and there are already three seed-stores working in Rangpur.

A zamindar of Tushbhander and the Rajah of Kakina have placed two corrugated iron sheds at our disposal, to be utilised as seed-stores. We will thus have about a dozen seed-stores working in this division during the next year. It will, however, be necessary to arrange for their proper management by appointing suitable seed-store clerks.

Exhibition.

On account of the agricultural distress throughout the division and the stringent financial condition, no exhibitions were held in any part of the division.

Seed Farm.

The Demonstration Farm at Rangpur is now being worked mainly for the production of improved seed, testing of improved varieties against local varieties and the demonstration of manures. A new District Farm has been started at Bogra. The land has been acquired and the buildings have been started and will be finished by the 31st March. The District Board of Pabna has offered to bear the cost of the acquisition of land for a farm at Pabna and also to make an annual contribution of Rs. 1,000 towards recurring expenses. It is proposed to start the farm immediately. Arrangements are also being made to start a small farm on the Khashmahal Estate at Khanjaupur (Bogra).

Agricultural Associations.

There are three Agricultural Associations in the division, one at Bogra, one at Malda, and the other at Rangpur. The Bogra Association held a meeting to discuss the programme of work for the next year, but no work was done during the year under report. The Rangpur Association held two meetings during the year, and discussed the steps to be taken for the extension of food crops in the district. The association helped the growers of Sumatra tobacco by putting up curing sheds. It is, perhaps, necessary to reconsider the constitution of the associations if they are to render effective assistance in regard to agricultural improvements in the districts. Smaller associations of rural cultivators will perhaps be more useful.

My thanks are due to all the Collectors, Subdivisional Officers and those who have all helped in our work. Thanks are also particularly due to the District Boards of Pabna, Rajshahi and Rangpur. Many of the zemindars and non-officials helped in the distribution of improved seeds. Special thanks are due to the zemindar of Tarashia Estate in the Rajshahi District who purchased a large quantity of rabi seeds for distribution among his tenants.

J. N. CHAKRAVARTY,

Superintendent of Agriculture, Rajshahi Division.

Statement showing the Assets and Liabilities of the Rajshahi Divisional Seed-store for the year 1918-19.

Assets.			Liabilities.			
	Amount.	Amount.		Amount.	Amount.	Amount.
	Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.	Rs A. P.
Total amount in cash realised in year under report.	3,528 7 3		Rent	1,677 3 9		
Deduct outstanding of last year realised in year under report.	290 0 0		*Deduct* rent for the office of the Superintendent of Agriculture and District Agricultural Officers.	960 0 0	717 3 7	
Cash receipts for current year ...	...	3,238 7 3				
Bills outstanding	3,081 12 10					
Deduct on account of bad debts non-realisable and written off,	...		Establishment	...	535 3 7	
			Contingencies	600 0 0		
			Deduct on account of flood work.	180 0 0	420 0 0	
		3,081 12 10				
		6,320 4 1				
Profit and loss account ...	...	4,955 15 10	Packing and freight charges	...	239 11 9	
			Depreciation on materials ...	...	165 9 0	
		11,276 3 11	Cost of purchasing stores ...	...	6,720 7 4	
			Bills payable	...	1,693 12 0	
Amount of bills outstanding overdue.	...	.....				10,492 2 5
Amount of bills outstanding not yet overdue.	...	3,081 12 10				
			Cost price of stock-in-hand on 1st April 1918.	... ...	1,832 0 0	
			Cost price of stock-in-hand on 31st March 1919.	...	1,047 14 6	
			Reduction in stock	...	...	784 1 6
						11,276 3 11

ANNUAL REPORT OF THE CHINSURAH FARM FOR THE YEAR 1918-19.

Introduction.

1. The farm is situated to the west of the East Indian Railway line, between Chinsurah and Hooghly stations. It is only 38 " above sea-level. The station was opened in 1908. It consists of 210 acres and has a soil typical of the Hooghly district. Experiments on finding out better-paying methods and the most prolific and paying varieties of jute and winter paddy, along with sugarcane, plantain and papaya, and the extensive growing of recommended varieties thereof for seed-supply throughout the Province form the chief work.

The farm depends entirely on rainfall. Iron *dons* are chiefly used for waterlifts. Bullock-gear double chain pump works well for 10-12′ lifts. The existing Oil Engine pump requires the appointment of a mechanic or it gets frequently out of order.

II.—Soil.

The soil is mostly a clay loam and represents the Gangetic alluvium to the west of the Hooghly. It is fertile and capable of growing good crops.

III.—Season and Rainfall.

The utter absence of rainfall in January and February 1918 and the very poor rainfall in March 1918, badly affected the breaking up of land. Sugar-cane had to be planted under the most adverse conditions. The excess rain-fall of 7·38″ in May and June doomed the fate of the jute crop. For paddy the season was favourable up to September, after which the crop heavily suffered at flowering and milk stages for absolute want of rainfall.

The following table shows, in inches, the average normal rainfall at Sadar and the actuals recorded on the farm during the year :—

Months.	Average normal rainfall at Sadar (3 miles off).	Actual fall recorded on the farm.		Comparison with normal.	
		Rainfall.	No. of rainy days.	Excess.	Deficit.
1918.					
April	2·46	3·08	4	0·62	.....
May	5·85	8·78	12	2·93	.....
June	10·56	15·01	21	4·45*	.....
July	11·28	13·85	15	2·57	.....
August	11·64	13·89	21	2·25	.....
September ...	8·40	12·02	15	3·62	.....
October ...	4·09	*Nil.*	.....	.....	4·09
November ...	0·66	*Nil.*	*Nil.*	.....	0·66
December ...	0·19	*Nil.*	.....	.....	0·19
1919.					
January	0·38	0·30	1	.....	0·08
February ...	1·20	1·13	2	.....	0·07
March	1·58	0·59	1	.....	0·99
Total ...	58·29	68·65	92	16·44	6·08

* On the average the rainfall was 10·36 " in excess over normal in the year.

The table below show the average monthly temperatures (maximum and minimum) in *Fahrenheit* in the open and in shade on the farm for the year.

Average temperature.

—	Maximum.		Minimum Solar.	Gopown.	
	Solar.	Shade.		Maximum.	Minimum.
1918.					
April	99	91	74	110	74
May	103	94	80	113	79
June	89	82	81	101	80
July	102	89	82	103	87
August	88	84	82	105	81
September	87	79	77	96	72
October	95	86	72	100	68
November	91	84	67	99	63
December	84	73	60	90	49
1919.					
January	81	74	58	84	49
February	83	75	60	90	54
March	98	90	70	108	62

IV.—Scientific work done during the year.

1. Oryza Sativa—Dhan—Paddy.

A.—**Aus (Autumn paddy).**—The selected Kataktara Aus of the Economic Botanist was grown on ·7 acre to test suitability, and the outturn of 19 maunds of grain per acre obtained speaks for its suitability in the district.

B.—**Aman (Winter paddy).**—The fields could not be ploughed in time for want of rainfall from January to March. The excessive rains in May and June damaged the seedbeds and necessitated bailing out of water to save them and to transplant. Continued heavy rains however during the period of vegetative growth made the crop look very promising till the flowering time. The utter absence of rainfall at flower and milk stages badly affected the crop, particularly on higher situations.

(1) Development of selected seeds for distribution occupied an area of 93·7 acres.

(2) Trial with pure-line varieties was conducted on 3 acres under the guidance of the Economic Botanist and the results may be seen from his report.

(3) All the varieties of paddy collected from the Burdwan and Presidency Divisions were grown under the guidance of the Economic Botanist for observation and notes.

(4) The testing of plots in A Block for uniformity was continued. The result, shown in table below, show how variable the soil is from plot to plot in the same block.

The figures in Romans represent the outturn of grain from the plot (one-fifth acre) in 1917-18 and the figures in Italics represent that of 1918-19.

		Threshing	6 37 *3 35*	5 32 *4 31*	6 20 *4 16*	6 11 *5 36*	5 1 *6 7*	27
Irregular plot.		Floor	6 10 *4 34*	6 4 *4 29*	6 27 *4 35*	6 19 *6 5*	6 2 *6 19*	26
			4 35 *3 16*	5 33 *3 6*	5 38 *4 32*	6 22 *5 12*	6 27 *6 13*	6 2 *6 27*	25
			6 27 *3 2*	5 39 *3 7*	5 7 *3 34*	5 19 *2 39*	6 27 *4 22*	6 24 *6 1*	24
	5 20 *3 13*	...	6 6 *5 29*	...	6 32 *2 37*	*3 17*	6 8 *5 19*	23
5 19 *3 24*	4 1 *3 13*	6 9 *2 11*	5 30 *3 19*	5 12 *4 15*	5 28 *4 9*	5 38 *4 28*	5 37 *4 38*	22
5 39 *3 27*	5 18 *3 1*	6 4 *3 38*	6 7 *4 30*	6 35 *3 24*	5 22 *3 39*	5 11 *3 37*	6 0 *4 27*	21
5 12 *3 1*	5 14 *3 37*	5 22 *4 26*	5 30 *5 31*	5 38 *3 27*	6 6 *4 9*	6 12 *4 32*	7 5 *5 21*	20
Irregular areas.	5 21 *3 9*	5 21 *4 15*	5 13 *5 35*	4 7 *4 2*	6 39 *1 37*	6 6 *4 21*	7 23 *4 29*	19
	5 20 *4 39*	5 19 *4 18*	5 20 *1 31*	6 7 *4 7*	6 23 *3 7*	6 38 *3 26*	... *5 18*	18
	5 11 *5 12*	5 20 *3 1*	5 9 *3 4*	6 12 *4 18*	... *5 28*	7 5 *4 26*	... *6 3*	17
	6 1 *4 32*	... *1 23*	... *1 17*	6 20 *4 23*	6 27 *4 30*	6 16 *5 0*	... *5 30*	16
	5 27 *4 24*	... *1 17*	... ...	6 6 *3 10*	6 39 *6 1*	6 26 *5 39*	... *8 2*	15
	5 35 *3 37*	... *1 34*	... ...	6 1 *3 19*	6 11 *5 17*	6 37 *6 8*	... *7 24*	14
	4 37 *3 26*	... *1 15*	... *2 18*	4 17 *0 33*	6 38 *6 5*	5 32 *5 17*	... *6 30*	13
	5 20 *3 10*	4 18 *1 36*	4 11 *1 7*	6 12 *4 34*	6 31 *4 7*	7 17 *6 35*	6 16 *6 15*	12
	5 2 *3 4*	4 37 *2 34*	4 33 *1 1*	6 28 *5 6*	6 39 *5 2*	7 4 *6 16*	6 12 *6 5*	11
	6 11 *3 27*	4 32 *3 10*	6 20 *4 7*	6 26 *5 5*	6 35 *5 38*	7 13 *6 7*	6 29 *6 1*	10
	5 18 *4 10*	6 11 *4 32*	6 29 *4 36*	6 9 *4 18*	5 39 *2 30*	6 21 *6 13*	6 12 *5 39*	9
	... *3 0*	6 29 *5 35*	... *5 7*	5 17 *4 20*	... *5 33*	5 38 *6 33*	5 36 *5 29*	8
	5 23 *4 28*	5 37 *6 6*	6 0 *6 14*	6 12 *5 8*	6 4 *5 17*	5 39 *6 6*	5 17 *5 13*	7
	5 31 *5 3*	5 34 *6 6*	6 6 *6 27*	6 14 *5 23*	5 37 *5 36*	5 36 *6 8*	3 8 *5 17*	6
		6 9 *5 33*	5 38 *6 25*	6 11 *5 15*	6 15 *6 18*	6 2 *6 12*	5 38 *5 39*	5
			5 24 *6 6*	6 13 *4 38*	5 25 *8 38*	5 37 *6 7*	5 35 *5 36*	4
			4 22 *4 6*	... *4 24*	5 8 *6 0*	4 0 *5 10*	5 2 *5 31*	3
				5 13 *5 3*	5 36 *5 34*	4 28 *5 29*	5 11 *6 9*	2
						6 7 *5 35*	5 16 *5 23*	1
								0

(5) **Medium varieties.**—Dacca No. 1 (Indrasail), Nagra, Jhingashal and Hatishal were grown on one-fourth acre each with four duplications in varying positions, to find out the season's bearing on their respective outturn. From the results, shown below, it appears that Hatishal cannot stand excess water and that Dacca No. 1 and Jhingashal want more rainfall than was obtained in the year.

OUTTURN PER ACRE.

NAGRA.				INDRASAIL.				HATISHAL.				JHINGASHAL.			
Grain.		Straw.		Grain.		Straw.		Grain.		Straw.		Grain.		Straw.	
Md.	Owt. qrs. lbs.	Md.	Owt. qrs lbs	Md.	Owt. qrs. lbs.	Md.	Owt. qrs. lbs.	Md.	Owt. qrs. lbs.	Md.	Owt. qrs. lbs.	Md.	Owt. qrs. lbs.	Mds.	Owt. qrs. lbs.
							1917-18.								
35½	25 3 14⅝	38	27 2 27½	29	21 0 23⅝	41½	28 3 22½	21½	13 0 6	44½	32 3 7	21	15 1 26½	35½	26 0 15½
25⅝	18 3 17½	35	25 1 25½	21⅛	15 3 7	38	27 3 8	18¼	13 1 26⅝	24	17 2 24	21	15 2 4½	39½	28 3 10⅝
29½	21 1 14½	43	30 2 26½	26⅝	19 2 1½	49½	36 0 18⅝	22	15 3 27	35⅝	25 3 4½	18½	13 1 20½	37	27 0 1½
26⅝	19 2 1	38½	28 0 21	26½	19 0 24½	52	38 0 16	22½	17 0 4½	56	41 0 8	21½	15 3 9	35½	25 3 4½
31⅝	21 1 19	38½	28 0 4	25⅝	18 3 21	45½	32 3 2½	21	14 3 16	40	29 1 10⅝	20½	15 0 8	36⅝	26 3 22 Average.
							1918-19.								
33⅝	24 1 6½	42½	29 2 3½	38½	27 3 20½	50	34 2 12	28⅝	21 0 5½	46½	33 3 16	35	25 3 20½	51½	37 2 14⅝
37½	27 1 19⅝	47½	34 3 19	26⅝	26 3 13	59½	43 2 7	27	19 3 14½	43½	31 0 7	34	24 3 22½	42⅝	31 1 9
38	27 3 8	47½	34 3 19	39	28 2 14½	66⅝	48 3 25⅝	31⅝	22 3 23	59⅝	43 3 3½	38⅝	28 1 21½	42⅝	31 1 17⅝
34½	25 0 2½	40⅝	31 1 17⅝	30⅝	29 0 27⅝	62½	45 3 1	30½	22 1 ½	51½	37 3 3	32	23 2 2½	38	27 3 8
35⅝	26 0 16	44½	32 2 21⅝	38½	28 0 19	59⅝	43 0 25½	29½	21 2 6	50½	36 2 14½	35	25 2 23½	43⅝	32 0 5½ Average.

(6) **Fine varieties.**—Badsabhog, Kataribhog, Dadkhani and Samudrabali were tried against each other on ¼th acre each with four duplications in varying positions and it appears from the table below that Kataribhog is one of the best yielder the fine group.

APPENDIX.

OUTTURN PER ACRE.

BADSHABHOG.				KATARIBHOG.				DADKHANI.				SAMUDRABALI.			
Grain.		Straw.		Grain.		Straw.		Grain.		Straw.		Grain.		Straw.	
Md.	Owt. qrs. lbs.	Md.	Owt. qr. lbs.	Md.	Owt. qr. lbs.	Md.	Owt. qr. lbs.	Md.	Owt. qr. lbs.	Md.	Owt. qr. lbs.	Md.	Owt. qr. lbs.	Md.	Owt. qr. lbs.
23½	17 0 27	38	27 3 8	7¼	5 1 0	32	23 1 20	16	11 3 4	31¼	25 0 8	5⅝	4 0 17	35	25 2 14
5½	3 3 21	32⅝	26 1 15	21½	16 2 12⅝	38¼	28 0 ¼	13¼	9 2 14	33	24 0 18	2⅝	2 0 9½	30¼	28 2 26
6½	4 2 8½	37⅝	27 2 15½	18	13 0 22	38	27 3 8	14⅝	10 1 16	41¼	28 3 22½	10¼	7 2 ½	38	27 3 8
13⅝	10 2 13½	38¼	28 0 ¼	12⅝	9 1 10	47	28 0 5⅝	13½	9 2 26½	30	21 3 24	25⅝	18 3 3½	50¼	36 3 4
12¼	8 3 24½	36½	26 2 25	14⅝	10 3 5¼	38⅝	28 1 13½	14¼	10 1 20½	34⅛	25 0 8½	11	8 3 22	40½	29 2 17 average

(7) **Manurial.**—(*i*) The experiments were made with Nagra paddy. The respective outturns from the application of different manures, as given in tables 1 and 2 below, show that green-manuring with Dhaincha on the higher plots is the most economical manure for winter paddy. The results of previous years in table 3 below show that Dhanicha beat cowdung in five cases out of six and unmanured by an average of 6 maunds of grain per acre, while the cost of Dhaincha manuring did not exceed Re. 1-8 per acre.

Table 1.

Manures applied.	Outturn per acre. Grain. Md.	Cwt.	qr.	lbs.	Straw. Md.	Cwt.	qr.	lbs.
I. O. P. Cake at 6 mds. per acre	22½	15	1	10	37½	27	1	6
Castor cake „ „	22½	16	3	0	33	24	1	12
Cowdung at 100 mds. per acre	19½	14	0	11	28	20	1	22
Dhaincha green-manured	26½	19	0	26	40	29	1	18

Table 2.

Manures applied.	Outturn per acre. Grain. Md.	Cwt.	qr.	lbs.	Straw. Md.	Cwt.	qr.	lbs.
Unmanured	25½	18	1	26	49	27	2	14
Dhaincha green-manured.	27½	19	3	22	32½	23	3	25

Table 3.

Manures applied per acre.	Average outturn per acre in maunds (82 lbs). 1912-13. Grain.	Straw.	1913-14. Grain.	Straw.	1914-15. Grain.	Straw.	1915-16. Grain.	Straw.	1916-17. Grain.	Straw.	1917-18. Grain.	Straw.
Unmanured	21	30	24	32	14	25	18	23	12	11	31	39
Cow-dung 100 maunds	23	37	33	44	17	28	24	27	14	15	27	42
Dhaincha green-manured	29	46	29	34	18	34	29	36	17	17	33	48

(*ii*) The difference in outturn from using castor and I. O. P. cakes as manure was tested and the results below point to a slight superiority of I. O. P. cake over castor cake.

Outturn per acre.

Manures applied per acre.	Outturn per acre. Grain. Mds.	Cwt.	qrs.	lbs.	Straw. Mds.	Cwt.	qrs.	lbs.
Unmanured	24½	18	0	17	38	27	3	8
Castor cake at 6 maunds ...	29	21	0	18	43	31	2	18
I. O. P. cake at 6 maunds ...	30	22	3	0	48	35	1	8

Corchorus olitorius—Lamba Shunti Pat—Long Podded Jute.

2. The utter absence of rainfall in January-February and the very deficient fall in March 1918 delayed preparation of land, while the excess fall of 9·95 inches (37·64 inches against normal 27·69 inches) in May-July badly affected the young crop and entailed elaborate drainage arrangements.

Seed selection and pure-line tests were done under the guidance of the Fibre Expert and his report may be seen in this connection.

Sacharum officinarum—Sugarcane—Akh.

3. The adverse weather condition from January to March before the year under report made planting very late and too many blanks occurred (through want of water on the farm) to admit of experimental purposes ; further, the excess rainfall of 15·82 inches (63·55 inches against normal 47·73 inches) from

May to September brought on heavy water-logging, as the farm can never be drained of such excess water under existing conditions. Still the following observations may definitely be made :—

A.—Of all the hard varieties, *Mauritius Tanna* (both white and striped) is the best for *gur*-making. It is a very hardy cane and has yielded an increased outturn of about 60 maunds of *gur* per acre over Shamsara, the best of the local canes.

B.—As to the intermediate types, Red Mauritius and Barbedoes No. 3412 give better outturn of *gur* than Shamsara, while Barbedoes No. 147 is equal to it.

C.—Among the thick and soft canes, Shamsara, Vendamukhi of Rajshahi, Dacca Gandari and Barbedoes No. 208 may be mentioned, serially in order of merit. Barbedoes No. 208, with all its highest percentage of sucrose and big crystals, is not a cane for the ryot inasmuch as it is of the most delicate habits and liable to all diseases and pests and succumbs first to any adverse condition.

All the canes of Burdwan Division, other than Shamsara, have already been proved to be of poor quality.

About 65,000 sound and healthy sets of selected types have been distributed to the Western Circle during the year, for demonstration. The spread of improved canes and the increasing demand for cutting have been definitely noticed. Demonstration on the manufacture of high-class *gur* was well attended to by interested persons.

Musa Paradisiaca—Bannana—Kala.

4. The Amrita-Sagar variety of Dacca—Rampal has been observed to be of delicate habits. The demand for trained shoots is rapidly increasing.

Carica Papaya—Papaw—Penpey.

5. The Ceylon and Bangalore types have attracted considerable attention. The plants are now three years old and the plantation is to be renewed next year.

Canna Edulis—Arrowroot—Ararut.

6. The plantation could not be extended through unusual weather conditions. The starch manufactured for demonstration has been of fine quality.

Supply of Seeds.

7. The demand for farm seeds has increased to such an extent that it has been found difficult to satisfy all. The following seeds were distributed from the farm during the year under report.

	Mds.	Srs.	Ch.	Mds.	Srs.	Ch.
(*i*) Paddy	...			2,478	35	0
(1) Indrasail ...	2,078	32	8			
(2) Nagra ...	342	7	0	...		
(3) Hatishal ...	20	10	0	...		
(4) Jhingashal ...	8	0	0	...		
(5) Badshabhog ...	10	20	0	...		
(6) Samudrabali ...	3	7	8	...		
(7) Dadkhani ...	9	35	0	...		
(8) Kataribhog ...	6	3	0	...		
(*ii*) Arahar seed ...	...			0	2	8
(*iii*) Sugarcane cuttings ...	...			66,275 sets		
(*iv*) Banana suckers ...	...			52 No.		
(*v*) Papaw seed ...	...			1¼ tolas.		

V.—Fishery.

The newly reclaimed tank near the office was stocked with fry under the guidance of Mr. Southwell, who during his last inspection furnished regular instructions on the culture.

VI.—Visitors, Conferences and Exhibitions.

The number of interested visitors has appreciably increased.

Conferences, one at the Burdwan Farm and the other at this farm, presided over by the Divisional Commissioner, with exhibitions, were successfully held during the year and were created a lot of interest among the general public as well as cultivators.

VII.—Practical training of young men.

Three trained apprentices were sent out as demonstrators during the year. Some of the demonstrators sent out in previous years are reported to be doing really good work. It has been decided to open an Agricultural Middle School at the farm, and arrangements are being made for the construction of buildings, etc.

VIII.—Management and Supervision.

Babu Chuni Lal Mustafi was in charge of the farm during the year, assisted by three overseers and a clerk.

The Deputy Director of Agriculture, Western Circle, made frequent inspections. The Fibre Expert and the Economic Botanist visited at times and guided all scientific experiments. The Director of Agriculture, Bengal, inspected the farm some three or four times during the period.

Receipts and Expenditure 1918-19.

RECEIPTS.			EXPENDITURE.		
Particulars.	Total Amount.	Net amount for 1918-19.	Particulars.	Amount.	Total.
	Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.
Total cash receipts in 1918-19 ...	7,769 2 3		1. Feed of cattle	1,300 0 0	
Remitted to treasury 7,721 6 3					
Received on afternoon of 31st March 1919. 47 12 0					
			2. Seeds, manures and implements.	500 0 0	
Deduct receipts on account of previous years.	5,902 0 0				
Cash receipts for the current year	...	1,867 2 3			
Bills receivable	728 14 0		3. Wages of labourers ...	13,499 15 7	
Deduct overdue bills for 1915-16 118 13 0					
Ditto 1916-17 56 14 0					
Ditto 1917-18 34 14 0	210 2 0		4. Petty construction and repairs.	125 0 0	
Outstanding bills for the current year.	...	518 5 0			
Bills receivable on 1917-18 stock 52 11 6			5. Rail and steamer freight	50 0 0	
Bills receivable on 1918-19 stock 465 9 6					
Valuation of seeds sent out for demonstration.	7,750 5 9		6. Cooly and cart hire ...	55 0 0	
Deduct value of 1917-18 stock supplied.	4,109 1 9				
Valuation of seeds sent out for demonstration from current year's stock.	...	3,641 4 0	7. Service postage and telegrams.	60 0 0	
Total value of seeds as per stock book of 1918-19	19,300 14 9		8. Medical aid	150 0 0	
Depreciation on 1917-18 stock ... 3 1 3					
Value of stock disbursed during the year. 16,005 13 0	16,008 14 3		9. Office and miscellaneous	1,710 0 0	
Value of stock in hand on 1st April 1919.	...	3,292 0 6			
Grand Total of receipts in 1918-19.	...	9,318 11 9	Grand Total ...	...	17,449 15 7

The thanks of the Department are due to Mr. D. H. Lees, I.C.S., Commissioner of the Burdwan Division, Mr. S. C. Mukherji, I.C.S., Mr. A. N. Moberly, I.C.S., Collector of Hooghly, Mr. T. Southwell, Director of Fisheries, and to the authorities of the East Indian Railway, Eastern Bengal Railway and Bengal Nagpur Railway, for their kind help and co-operation.

R. DAS GUPTA,
Offg. Deputy Director of Agriculture,
Western Circle, Bengal.

ANNUAL REPORT OF THE BURIRHAT FARM FOR THE YEAR 1918-19.

Introductory.—The Burirhat Farm is situated on the borders of the tobacco growing tract, 5 miles north of the Rangpur town. It is mainly intended for tobacco experiments. The area of the farm is 52 acres, of which 38 acres are under cultivation, the remainder being occupied by roads, buildings, etc. The soil is a sandy loam with a sandy sub-soil rather deficient in lime. The soil although originally very poor has greatly been improved by systematic cultivation and proper manuring. Any part of the farm is now capable of producing good crops of tobacco.

Season.—On the whole the season was favourable for tobacco. The heavy rainfalls in August caused some inconvenience in raising seedlings. The weather during the growing period, *i.e.*, from October to February, was dry and waterings were necessary. The crop was uniform and good. The following table gives the rainfall during the year :—

Months.	Actual Rainfall.		Normal.	
	Rainfall.	Number of rainy days.	Rainfall.	Number of rainy days.
1918.	Inches.		Inches.	
April	3·28	4	3·01	4·3
May	10·26	11	10·66	11·5
June	33·81	20	18·00	15·0
July	26·90	19	15·89	15·0
August	26·80	15	12·80	13·7
September	6·98	14	1·24	13·3
October	Nil	Nil	4·87	4·4
November	Nil	Nil	0·12	0·2
December	Nil	Nil	0·05	0·2
1919.				
January	0·63	3	0·05	0·9
February	0·29	2	0·54	1·2
March	Nil	Nil	1·25	1·8
Total ...	108·33	88	81·48	81·5

Crops.

		Acre.
I.	*Bhadoi*—	
	(*a*) Cowpea for green manuring tobacco	24
	(*b*) Juar for fodder	1
	(*c*) Aus paddy	13
II.	*Rabi*—	
	(*a*) Tobacco—	
	Local—	
	(*i*) Bhengi	6·6
	(*ii*) Hamaku	3·3
	Exotic—	
	(*i*) Sumatra	4
	(*ii*) Havana	·30
	(*iii*) American cigarette tobacco	·50
	1. White Barley.	
	2. Yellow Prior.	
	3. Orinoko.	
	(*iv*) Turkish	·30
	Cavala.	
	Yasaolouk.	
	(*v*) Varieties from the different districts ...	·30
	Total Tobacco area ...	15·30
	(*b*) Lentils (*Arvum-lens*)	9
	(*c*) Oats (*Avena Sativa*) and Peas (Pisum Arvense) ...	14·00

Experiments.

1. Improvement of Sumatra tobacco.
2. Trial of American and Turkish varieties for cigarette manufacture.
3. Comparison of difierent varieties of tobacco generally grown in the province.
4. Improvement of local varieties by selection.
5. Manurial requirements of tobacco.
6. Trial of Kataktara aus paddy against best local aus varieties.

Sumatra tobacco.—Great improvement has been made by using seeds raised from very carefully selected plants. The crop obtained has been accepted by the market as highly superior; a sum of Rs. 5,625 has been obtained from the sale of about 2,000 lbs. of tobacco at the rate of Rs. 2-13 per lb., the average outturn being 1,017·6 lbs. per acre. This year we have 4 acres of Sumatra tobacco in the farm as compared with 2·83 acres in the last year. The cultivators are taking up the cultivation of this tobacco very lagerly.

Cigarette tobacco.—Small quantities of some American and Turkish varieties are grown in the farm to study their field character and suitability for the manufacture of cigarettes. The former is found to be thick, coarse and strong, and as such did not prove to be quite suitable, but the Turkish one were found to be mild and made good cigarettes. Properly cultivated these might replace the foreign tobacco imported for cigarette-making.

Rangpur *versus* other district varieties.—The comparison is being carried on since the last three years, with the result that the district varieties were every year beaten by the local ones. The district varieties seem to have degenerated, due to indifferent cultivation and treatment of years, and renewal of seeds from the Rangpur variety will probably remedy the defect.

Manurial requirement for tobacco.—The value of green-manuring with cowpea has been thoroughly established. An experiment of green-manuring with Sunn hemp (*Crotolaria Juncea*) as compared with 100 maunds and 200 maunds of cowdung in the cultivation of local Bhengi is in progress. The outturns in the form of the green weight of the tobacco leaves are as follows :—

Plot No.	Manure applied.	Area.	Actual outturn in maunds (green).	Outturn per acre.	Remarks. Dry weight actual.
			Mds. srs. ch.	Mds srs. ch	Mds. srs. ch.
1	200 maunds cowdung ...	⅛th acre ...	10 29 12	53 28 12	2 16 11
2	100 ditto ...	Do ...	7 18 8	37 12 8	1 25 0
3	Green-manure Sunn hemp	Do ...	12 21 0	62 25 0	2 16 12
4	200 maunds cowdung ...	Do ...	10 5 6	50 26 14	2 10 0
5	100 ditto ...	Do ...	8 36 0	44 20 0	1 31 8
6	Green-manure Sunn hemp	Do ...	12 28 0	63 20 0	3 0 6

Kataktara Aus Paddy.—Kataktara tried against the best local yielder Garia (aus) gave the following result :—

Name of the variety	Area.	Actual outturn.	Yield per acre.
		Mds. srs. ch.	Mds. srs. ch.
Kataktara	1·3	22 26 8	17 0 0
Garia	1·3	14 30 0	11 2 8
		Mds. srs. ch.	
Increased outturn per acre	...	5 37 8	

Manufacture of Chercots.—The demand of Burirhat cigars has greatly increased. The quality of cigars made has also been much improved. At present there are one cigar-roller and three apprentices, but they are hardly sufficient to meet the demands. The total receipts from the sale of cigars this year is Rs. 507-1.

Demonstrations.—In order to popularise the cultivation of Sumatra and other superior varieties of tobacco selected seeds from this farm are supplied to the cultivators round about the Burirhat Farm, who are erecting their own curing sheds. Nearly 15 bighas of Sumatra tobacco have this year been cultivated by them.

Implements.—The spring tooth harrow and Planet Junior hand-hoe have been found very useful. The hoe invented by Babu J. K. Biswas, the late Superintendent of the Burirhat Farm, is also in use and doing very useful work.

Management.—Babu Benode Behary Ghosh, Overseer of the Farm, officiated as Superintendent during the year.

Inspection.—The farm was once inspected by the Director of Agriculture, Bengal, and several times by the Deputy Director of Agriculture.

Financial Statement.

The following table shows the receipts and expenditure of the farm during the year :—

Receipt.

	Rs.	A.	P.
Sale of cigars ...	507	1	0
Sale of tobacco ...	6,803	7	6
Sale of aus paddy ...	160	8	3
Sale of miscellaneous articles ...	4	8	0
Sale of tobacco seeds	6	4	0
Sale of lentils and oats ...	87	12	0
Total ...	7,569	8	9
Stock in hand ...	605	0	0
Total ...	8,174	8	9

Expenditure.

	Rs.	A.	P.
Pay of establishment	2,016	9	3
Travelling allowance of establishment ...	152	1	6
Purchase of food for cattle ...	510	3	9
Purchase of seeds and manures, etc. ...	400	2	3
Wages of farm labourers ...	3,721	3	9
Petty construction and repair ...	1,097	9	3
Railway and Steamer freight ...	51	6	0
Service, postage and telegram charges	58	8	0
Office expenses and miscellaneous contingencies ...	855	15	0
Total ...	8,863	10	9

R. DAS GUPTA,

Offg. Deputy Director of Agriculture, Western Circle, in charge Northern Circle.

ANNUAL REPORT OF THE RANGPUR CATTLE FARM FOR THE YEAR 1918-19.

Introductory.

The farm is situated very close to the Railway station on both sides of the Railway line and about 3 miles from the town.

The farm has an area of 332 acres of which 249 acres are high land, fit for jute, aus paddy, tobacco, sugarcane, potato, etc.; 65 acres low land fit for transplanted paddy, and 17 acres very low land fit for growing deep-water aman paddy. This land dries up in the winter. All the high land practically belongs to one type. The soil is sandy and deficient in lime.

In accordance with the policy laid down by Government, the farm is being conducted as an experimental one as regards cattle-breeding and as a fooder farm for the production of food for the cattle. Improvement of fooder crop will also be attempted.

With reference to breeds, indigenous cows of one type as the basis of experimental work and two classes of bulls, local and imported, the latter being selected animals of a milking type of Hansi cattle, are being used.

Laying out of plots.

The problem of laying out the farm properly has been taken in hand with satisfactory progress. A few blocks are being laid out in one-tenth acre standard plots for experimental purposes. Some of the blocks are very uneven in contour, with the result that portions get water-logged during heavy rains. To remedy this levelling and drainage are in progress. It is hoped that the work of laying out will be completed during the next season.

The farm now consists of the following areas :—

	Acres.
Under cultivation	200
Bamboo groves	5
Roads, drains, etc.	13
Farm steading and paddock	14
Pasture, tanks, thatching grass and unreclaimed	100
Total ...	332

Construction and repairs.

The shed for the milch cows has been thoroughly remodelled and repaired. Extra accommodation has been provided for the lying-in cows and heifers. A new shed has also been erected for the bulls. A small room has been added to the farm office to serve as a laboratory.

Stock of animals.

The two herds, viz., indigenous and cross-bred, are grazed and kept separately as before. The following was the stock of animals at the farm on the 31st March 1919 :—

Cows (Class I) ...	51	(with the Hansi Bull)
Do. (Class II) ...	43	(with the Country Bull)
Total ...	94	
Calves (Sucking)—		
Male ...	37	out of these 8 male calves and 9 female calves are the progeny of the Hansi Bull. These resemble their sire very closely.
Female ...	23	
Total ...	60	
Young stock, 1 year and above—		
Male ...	35	(out of these 6 have been castrated this year).
Female ...	30	
Total ...	65	
Bullocks ...	61	
Bulls ...	4	
Total ...	65	
GRAND TOTAL ...	284	

Disease and Casualties.

The herd was free from any infectious disease throughout the year. Three cows and ten calves died during the year.

The following table shows the average daily yield of milk per cow in lbs. for the years 1917-18 and 1918-19, respectively :—

1917.	lbs.
April	4·3
May	4·4
June	4·8
July	4·1
August	4·4
*September ...	2·5
October	2·1
November ...	2·2
December ...	2·6
1918.	
January	3·0
February	3·3
March	2·8
1918.	
April	2·05
May	1·88
June	1·97
July	1·71
August	2·09
September ...	2·03
October	2·61
November ...	2·21
December ...	3·72
1919.	
January	2·82
February	2·32
March	2·34

* The apparent drop from September 1917 onwards is due to the increased milk ration given to the calves (two full teats).

Rainfall statistics are as follows :—

Months.	Actual.		Normal.	
	Rainfall.	Rainy days.	Rainfall.	Rainy days.
1918.	Inches.		Inches.	
April	4·92	6	3·01	4·3
May	11·61	13	10·66	11·5
June	36·85	22	18·00	15·7
July	28·04	20	15·87	15·C
August	25·43	17	12·80	13·7
September	5·62	9	14·24	13·3
October	Nil	Nil	4·87	4·4
November	Nil	Nil	0·12	0·2
December	Nil	Nil	0·05	0·2
1919.				
January	0·38	2	0·50	0·9
February	Nil	Nil	0·54	1·2
March	Nil	Nil	1·25	1·8

The season was very unfavourable both to the *Kharif* and *Rabi* crops. The incessant and heavy rains in June, July and August flooded some of the Juar plots and hardly any second cutting could be taken. The subsequent drought again adversely affected the outturn of oats and peas, the main winter fodder crop.

The farm is now mainly under fodder crops, chiefly Maize (*Zea Mays*), Juar (*Andropogon Sorghum*) and Cowpea (*Vigna Catiang*) to be followed by Oats and Peas (*Avena Sativa* and *Pisum Sativum*) in the winter. During the year under report 45·66 acres of land were under Juar, 13·05 acres under Maize, 9·5 acres under Cowpea and 78·1 under Oats and Peas.

Several varieties of Juar and Maize were tried this year for fodder ; of these Fulgar Jaur and Kalimpong Maize (yellow) gave best results. The following additional crops were also grown during the year under report :—

(*a*) **Jute** (*Corchorus sp.*).—About 6 acres of land were under Fibre Expert's Jute (*Corchorus Olitorius*) for seed production. On account of bad season the crop was very poor and gave an outturn of 800 lbs. of seeds only.

(*b*) **Winter Paddy.**—Economic Botanist's Indrasail paddy Dacca No. 1 (*Oryza Sativa*) was grown on 26 acres of low land for producing pure seeds. An outturn of 31,980 lbs. (390 maunds) of seeds was obtained. The whole of this quantity will be used for seeds.

(*c*) **Flax**—(*Linum. Usita tissinum*) was grown on an area of 5 acres. The crop gave an outturn of 38½ maunds a fairly good straw and 4½ maunds of seed.

(*d*) **Lentils**—(*Lens esculenta*) were grown on an area of 10 acres, and gave an outturn of 7,634 lbs. (93 maunds and 4 seers).

Rangpur Cattle Farm.

Financial Statement for the year 1918-19.

Receipts.

	Rs.	A.	P.
Amount credited into treasury ...	10,204	5	3
Stock in hand on 1st April 1919 ...	1,622	7	0
Bills outstanding for farm produce of 1918-19 ...	1,203	5	6
Rents of the Superintendent of Agriculture's quarters credited into the treasury	120	8	9
Total ...	13,150	10	6
Deduct value of previous year's farm produce realised during this year ...	3,664	1	3
Total ...	9,486	9	3
Bills outstanding for previous year's farm produce ...	575	4	3
Grand Total ...	10,061	13	6

Expenditure.

	Rs.	A.	P.
Establishment ...	2,899	7	6
Special contingencies	48	2	0
Recurring expenditure	36,385	7	3
Value of cattle food held over from previous year's stock ...	246	1	6
Total ...	39,579	2	3
Deduct value of cattle food in stock on 1st April 1919 ...	117	11	0
Total ...	39,461	7	3

Staff.

Mr. J. N. Chakraborty, remained in charge of the farm up to 31st August 1918, and Babu S. C. Chakraborty from 1st September 1918 to the end of the year. There are two Assistant Superintendents—one in charge of the cattle and the other in charge of the cultivation—and two overseers.

Visits.

The farm was visited twice by the Director of Agriculture, and frequently by the Deputy Director of Agriculture.

R. DAS GUPTA,
Offg. Deputy Director of Agriculture,
Western Circle, in charge Northern Circle.

ANNUAL REPORT OF THE RANGPUR DEMONSTRATION FARM FOR THE YEAR 1918-19.

Introduction.—The farm is situated in the heart of the town of Rangpur. It was started in 1905 by the Rangpur District Agricultural Association. In 1911 it was made over to this Department and is being used for comparison of the best varieties of local crops with those of the Dacca station and for multiplication of experts, seeds for distribution in the district.

Area.—Out of 20 acres, the original area of the farm, the police acquired ·84 acres during the year. The farm has now an area of 19·16 acres, of which 16 acres are under cultivation. The remaining portion is occupied by roads, drains, pathways and building, etc.

Laying out of the Farm.—The whole farm has been laid out during the year into standard plots of $\frac{1}{10}$th acre each. This greatly facilitates cultivation and experimental work.

Buildings.—The land on which the old office and godown were situated has been handed over to the Police Department. These buildings have been dismantled and removed to a site near the main road facing the maidan. The cattle shed has also been removed and erected close to this site.

Rainfall.—The rainfall during the year under report was as follows :—

	Actual rainfall in inches.		Normal rainfall.	
	Amount.	Number of rainy days.	Amount.	Number of rainy days.
1918.				
April	4·92	6	3·01	4·3
May	11·62	13	10·66	11·5
June	36·85	22	18·00	15·7
July	28·04	20	15·89	15·0
August	25·43	17	12·80	13·7
September	5·62	9	14·24	13·3
October	Nil	Nil	4·87	4·4
November	Nil	Nil	0·12	0·2
December	Nil	Nil	0·05	0·2
1919.				
January	0·38	2	0·50	0·9
February	Nil	Nil	0·54	1·2
March	Nil	Nil	1·25	1·8
Total ...	112·86	89	81·93	82·2

The year has been a very unfavourable one. It will be seen that the rainfall in June, July and August was very heavy and caused much damage to the standing crops, especially sugarcane. After October the weather was unusually dry, causing much damage to the winter paddy. The outturn of *rabi* crops has also been unfavourably affected.

Soil.—The soil is a rich moist loam of light texture. The sub-soil at a depth of 3 or 4 feet is almost pure sand.

Crops grown during the year.—(*1*) *Aus* paddy (*Oryza Sativa*).

No.	Name of paddy.	Area in acres.	Actual outturn.			Outturn per acre.		
		Acres.	Cwt.	qr.	lbs.	Md.	sr.	ch.
1	Kataktara	·25	4	3	25	6	32	0
2	Pooki ...	1·03	10	1	16	14	8	0

(2) *Winter paddy*—Dacca No. 1. Indrasail was transplanted on standard plots $\frac{1}{10}$ acre, as well as on non-standard plots. The results are tabulated below :—

Block No.	Name of paddy.	Area in acres.	Actual outturn.	Outturn per acre.
		Acres.	T. cwt. lbs.	Cwt. qr. lbs.
3	Indrasail	1·6	1 3 9	14 2 4
			Mds. srs. [31 21]	Mds. srs. ch. [19 34 11]
			Cwt. qr. lbs.	Cwt. qr. lbs.
4	Do.	·8	12 0 0	15 0 14
			Mds. srs. [16 16]	Mds. srs. ch. [20 26 13]
			T. cwt. qr. lbs.	Cwt. qr. lbs.
5	Do.	1·6	1 2 2 12	14 1 0
			Mds. srs. ch. [30 35 8]	Mds. srs. ch. [19 18 10]
			Cwt. qr. lbs.	Cwt. qr. lbs.
6	Do.	·7	9 2 17	13 3 2
			Mds. srs. ch. [13 2 8]	Mds. srs. ch. [18 32 10]
			T. cwt. qr. lbs.	Cwt. qr. lbs.
3X, 6X, & 7	Do.	2·13	1 9 3 14	14 0 13
			Mds. srs. ch. [40 32 8]	Mds. srs. ch. [19 11 9]

(3) *Jute* (*Corchorus Capsularies*).—Kakya Bombai jute was tried in block No. 5 and gave an cutturn of 21 mds. 22 srs. (15 cwt. 3 qrs. 3½ lbs.) in 1·4 acre or 15 mds. 15 srs. 12 chs. (10 cwt. 5 qrs. 2 lbs.) of fibre per acre.

Keraniganj jute was grown on ·86 acres for seed and gave an outturn of 5 mds. 20 srs. 8 chs. per acre. The crop was attacked with the fungus disease *Deplodia*. Seeds obtained have been sent to the Fibre Expert.

(4) *Sugarcane* (*Saccharum Officinarum*).—The rattoon cane suffered very badly from water-logging and gave an outturn of only 712 lbs. of *gur* per acre.

On block No. 2 four varieties of Sugarcane, viz., Dacca Gandari, B.147, Red Mauritius and B.3412 were planted. The crop suffered very badly from water-logging. They were used for cuttings.

(5) *Potatoes* (*Solanum Tubersum*).—Only Nainital was grown in 1·03 acre and gave an outturn of 3 tons 16 cwt. per acre.

New Crop.—(1) *Cotton.*—The following 12 varieties of cotton sent by the Economic Botanist were tested :—

(1) Garo Hill small bolled, (2) Buri cotton, (3) Sindewtahi, (4) Broach cotton, (5) Cambodia, (6) Cambo, (7) Sea Island, (8) Bihar cotton, (9) Goseum, (10) K. 22, (11) Garo hill large bolled, (12) Dharwar cotton.

The crop was not a success.

(2) *Flax.*—Flax seed was sown in one-sixth acre of land and the outturn was as follows :—

Straw	540 lbs.	per acre.
Seed	96 „	

(3) *Mustard.*—Some English varieties of mustard sent by Messrs. Graham Co., viz., B. G. Brown and B. G. White, were tested against local mustard.

B. G. Brown did not germinate.

B. G. White germinated, but did not yield any seed.

Local mustard gave an outturn of 229 lbs. per acre.

Seventeen cottas of Kheshary, 11 bighas of oats and 15 cottas of oats and peas were grown for cattle food. They were cut green and given to cattle.

Seed Distribution.—Five maunds seeds of Aus Paddy, Kataktara, were sold as seed and 4 mds. 20 srs. of jute seeds were sent to the Fibre Expert. One hundred and twenty-five maunds of Indrasail paddy seeds have been kept in stock for distribution. All the sugarcane cuttings available were used in the farm.

Receipts and Expenditure.

		Rs.	A.	P.
Credited into the Treasury		1,063	11	0
Bills outstanding		303	14	9
Value of stock in hand		428	1	6
Total ...		1,795	11	3

Expenditure.

1.	Feed of cattle	250	0	0
2.	Seeds, implements and manures	350	0	0
3.	Wages of labourers	2,817	2	6*
4.	Repairs to buildings	3,604	5	9
5.	Railway, steamer freight and cooly-hire ...	41	2	6
6.	Service postage stamp	15	4	6
7.	Rents, rates and taxes	56	14	0
8.	Miscellaneous	155	2	9
	Total ...	7,290	0	0

R. DAS GUPTA,

Offg. Deputy Director of Agriculture,
Western Circle, in charge of Northern Circle.

ANNUAL REPORT OF THE RAJSHAHI FARM FOR THE YEAR 1918-19.

Introduction.

The farm is situated on the outskirts of the town of Rampore Boalia in the Rajshahi district.

The tolal area is 63 acres, of which 50 acres are under cultivation. the rest being under roads, buildings, tanks, etc.

The farm is laid out into four rectangular blocks divided by kutcha roads crossing each other almost at the centre of the farm. Only about a quarter of this road from the farm gate to the office has been metalled. Mango and other fruit grafts are being planted during the last few years along the boundary of the farm. Along the southern fencing cocoanut palms and Banana shoots have also been planted.

Soil.

About two-third of the farm area consists of high lands and the remainder of lowlands, fit for transplanted paddy. A large number of regular plots have been laid out for experimental purposes. The plots are being tested for evenness.

The soil of the farm is rich in lime, but poor in potash, phosphoric acid and organic matter.

* Cultivation Rs. 1,325.
Reclamation Rs. 1,492-2-6

Rainfall and Season.—The following table gives the rainfall during the year :—

Month.	Actual.		Normal.	
	Rainfall in inches.	No. of rainy days.	Rainfall in inches.	No. of rainy days.
1918.				
February ...	Nil	Nil	0·84	1·3
March ...	0·11	3	1·15	1·6
April ...	1·35	3	1·81	2·9
May ...	11·98	8	5·56	7·7
June ...	16·81	16	10·81	12·6
July ...	6·91	11	11·45	15·1
August ...	22·84	18	10·75	14·7
September ...	7·31	9	10·40	12·4
October ...	Nil	Nil	4·46	4·9
November ...	Nil	Nil	0·31	0·6
December ...	Nil	Nil	0·06	0·2
1919.				
January ...	1·33	5	0·34	0·8

As is evident from the figures, the year, on the whole, was very unfavourable to crops. A good deal of damage was done, especially to the sugarcane and jute by heavy rains in August. Continued drought from the beginning of October again very seriously interfered with the growth of all standing crops, viz., sugarcane, paddy, etc., and the rabi crops, *e.g.*, mustard, wheat, gram, oats, etc., also suffered very badly.

Work done.

The following works were undertaken during the year :—

(1) Varietal tests with—
  (*a*) Sugarcane (*Saccharum Officinarum*).
  (*b*) Jute (*Corchorus Olitorius*).

(2) Seed-production.
  (*a*) Jute.
  (*b*) Aman paddy.

(3) Manurial experiments with jute.

(4) Aus paddy. Til (*Sesamum Indicum*).

(5) Rabi crops, including potato (*Solanum Tuberasum*).

(6) Other trials—
  (*a*) Cotton (*Gossypium Special.*)
  (*b*) Mustard (*Brassica Special.*)

1. (*a*) **Sugarcane.**—As already noted the crop suffered very badly both on account of heavy rains and subsequent drought. The results are tabulated below :—

Area.	Varieties.	Weight of canes.	Weight of juice.	Weight of gur.	Yield of gur per acre.	Remarks.
		Mds. sr. ch.	Mds. sr. ch.	Mds. sr. ch.	Mds. sr. ch.	
1/5 acre	Yellow Tanna ...	56 14 10 or 4,621 lbs.	44 35 12 or 3,680 lbs.	6 4 0 or 500 lbs.	61 6 4 or 5,014 lbs.	
Do ...	Striped Tanna ...	43 10 0 or 3,546 lbs.	28 9 8 or 2,315 lbs.	4 33 2 or 395 lbs.	48 11 4 or 3,959 lbs.	
Do. ...	B. 147 ...	40 31 2 or 3,343 lbs.	28 0 0 or 2,296 lbs.	4 25 9 or 380 lbs.	46 15 10 or 3,804 lbs.	
Do. ...	Vendamukhi ...	36 10 1 or 2,972 lbs.	22 9 4 or 1,823 lbs.	3 15 11 or 278 lbs.	33 36 14 or 2.780 lbs.	
Do. ...	Dacca Gandari ...	25 18 11 or 2.088 lbs.	17 23 6 or 1,442 lbs.	2 38. 3 or 242 lbs.	29 28 2 or 2,435 lbs.	
Do. ...	B. 3412 ...	26 12 7 or 2,157 lbs.	17 26 10 or 1,448 lbs.	2 23 12 or 212 lbs.	25 37 8 or 2,126 lbs.	

The outturns on account of unfavourable climatic conditions are much poorer than those of last year. But as in previous years Yellow Tanna gave the highest yield. The canes in general were greatly damaged by wild animals, as in previous years, but Tanna seems more or less immune to those ravages.

Besides the experimental plots one acre was allotted for seed production. Twenty-one thousand two hundred and twenty-five cuttings of the following varieties were supplied to the outside public :—

Yellow Tanna.
Striped Tanna.
B. 147.
Vendamukhi.
Dacca Gandari.
B. 3412.

The supply of cuttings this year, which was designed to have exceeded the number in past years, was, owing to a sudden fire in the cuttings shed, considerably reduced.

Jute experiments.—(*b*) *Jute Varietal.*—The following varieties of Olitorius seeds were tested, viz., R.26, Dacca Green, R.27, R.30, R.62 and R.29. Dacca Green has topped the list and has marvellously gone ahead of R.26, which was considered the heaviest yielder till last year. Tests will be continued next year.

The results are given below :—

Results of Varietal experiments with jute.

Plot No.	Area in acres.	Name of the variety.	Actual weight of fibre in lbs.	Weight of fibre in lbs. per acre.
1	·05	R.26	61	1,220
2	·05	Dacca green	84	1,680
3	·05	Ditto	87	1,740
4	·05	R.27	72·5	1,450
5	·05	R.26	76	1,520
6	·05	R.30	65	1,300
7	·05	R.26	62·5	1,250
8	·05	R.30	68	1,360
9	·05	R.26	62·5	1,250
10	·05	R.62	63	1,260
11	·05	R.26	26·5	1,130
12	·05	R.62	55·5	1,110
13	·05	R.26	69	1,380
14	·05	R.29	51	1,020
15	·05	R.26	63	1,260
16	·05	R.29	61	1,220
17	·05	R.26	69	1,380
18	·05	Dacca green	86	1,720
19	·05	R.26	64·5	1,290
20	·05	Dacca green	88·5	1,770
21	·05	R.26	61	1,220
22	·05	R.27	68	1,360

Seed production.

2. (*a*) **Jute, Dacca Green.**—This was tried on ·08 acres of land. It grew fairly well, though much affected by the unfavourable weather conditions and gave an outturn of 312 lbs. of seed. The dry stalks were burnt, and the ash weighed 2 maunds and 36 seers. The whole of this will be used as manure during the coming season.

(*b*) **Aman paddy, Indrasail.**—Twenty acres of land were put under Indrasail for the multiplication of pure seeds. The total yield was 15,794 lbs. of seeds. The outturn was far below the normal, due to flood and drought.

Manurial experiments with Jute.

3. As the farm soil is poor in Potash content, *Rhizoctonia* made its appearance in a virulent form in 1915. For studying systematically if the presence of Potash in proper proportions in the soil is a check to the appearance of this disease, manurial experiments with potash have been conducted for the last few years by the Fibre Expert. This will be continued in the next year also. It is too early to give any results now.

The following crops were grown in the farm.

Aus, Kasia, Panja.

4. This is the heaviest yielding local coarse aus paddy. It was grown on 12·10 acres of land. The yield given was 14,882 lbs. This variety will be tested against Kataktara next year.

Rabi crops.

5. **Wheat (Triticum Sativum).**—Pusa wheat No. 12 is being tried in this farm for the last four years. The season was very unfavourable, but a slight shower in January saved the crop from total failure.

Four and one-third acres were put under this corp. The yield was 906 lbs. per acre. The cultivators have begun to appreciate this variety. The demand for seed is expected to increase greatly next year.

Gram (Cicer arietinum).—The crop was grown on 3·3 acres of land. The yield of grain was 1,072 lbs. per acre.

Oats (Avena Sativum).—The crop was grown on 1·08 acres of land. The yield of grain was 615 lbs. per acre.

Joar (Andropogon Sorghum).—The crop was grown on ·66 acres of land for fodder and was fed green to cattle.

Mustard (Brassica Special).—This crop was put on 1·25 acres of land and an outturn of 623 lbs. per acre was obtained.

Til (Sesamum Indicum).—This crop was grown on ·6 acre of virgin land newly brought under cultivation. The yield was 273 lbs. of seeds.

Potato (Solanum Tuberasum).—Both Darjeeling and Nainital potatoes were grown on 1·06 acres of land without irrigation, but the results were not promising. Darjeeling variety was grown on ·57 acres of land and Nainital on ·49 acres, with an yield of 3,931 lbs. and 1,341 lbs., respectively. Systematic varietal aud manurial experiments will be conducted next year. Several varieties of English and Deshi vegetables were grown.

Other trials.

6. (*a*) **Cotton (Gossypium Special).**—Cotton was tried for the first time this year in this farm. Dharwar American was sown on ·08 acres of land during the monsoon, middle of July.

The vegetative growth of the plants was fairly satisfactory. Heavy rains in August damaged the plants to some extent. The crop bore flowers and fruits much later than expected. The picking of bolls could only be commenced as late as the last week of February. The bolls were found to be very small in size varying from ¾ to 1 inch only. Consequently the length of the lint was short also. The plants which still stand seem to be behaving very indifferently now, as coming out of new vegetative shoots, flowering of buds and ripening of bolls are all going on simultaneously. Up to date about 17 seers of cotton (with seeds) have been picked.

During the winter the following 12 varieties of cotton were received from the Economic Botanist :—

1. Roseum.
2. Combo.
3. K.22.
4. Dharwar American.
5. Cambodia.
6. Broach.
7. Buri.
8. Bihar Cotton.
9. Sea Island.
10. Sindewahi (cross).
11. Garo Hill (large bolled).
12. Garo Hill (small bolled).

Each variety was sown on separate line during the last week of September on high-drained land on ridges. Amongst those Combo, Dharwar American, Cambodia and Buri are growing better than others, while Roseum, K. 22, Sea Island, Sindewahi (cross) and Garo Hills (small bolled) have completely died out during the drought ; the rest Garo Hill (large bolled), Bihar cotton and Broach are growing very indifferently. All the varieties have come into flowers. They are still under observation.

(*b*) **Mustard (Brassica) Special.**—Two varieties of mustard, brown and green were sent by Messrs. Graham & Co., Calcutta, for a trial here. They were sown in plots of $\frac{1}{10}$th acre with the Deshi mustard as check between them.

The germination of the brown variety was very bad and proved almost a failure. The yellow variety germinated as much as 50 per cent. The plants grew, as high as 5 feet. About 95 per cent. of the plants, however, did not develop any pods, the flowers simply drying. The others bore a few pods; which, however, contained only one or two seeds.

Seed Supply.—During the year 19,459 lbs. of Indrasail paddy and 1,897 lbs. of Pusa wheat No. 12 and 21,225 sugarcane cuttings were supplied for seed purposes.

Poultry.—Both fowls and ducks are reared here. There is only one variety of fowl, Buff Langshan, the stock consisting of 1 cock and 4 hens. Amongst the hens three are cross-breds with Deshi. The ducks are all Deshi and number 7. One hundred and sixty-eight eggs have been sold outside during the year to improve the stocks of villagers. The demand for improved breeds is really very great here.

Training in Practical Agriculture.

Kumar Sarat Kumar Ray, of Dayarampur, sent a man here for training for a short time. He was trained in the cultivation of sugarcane and *gur*-making only.

Visitors.

The Deputy Director of Agriculture and the Superintendent of Agriculture inspected the farm several times. The farm was visited thrice by the Fibre Expert, once by the Economic Botanist and several times by the Collector. The farm was also visited once by the Imperial Mycologist from Pusa. Dr. D. P. Sarvadikari also visited the farm once.

Staff.

Babu Kalidas Ray held charge as Farm Superintendent, up till 27th July 1918, when Babu C. C. Sanyal took over charge from him. Much of his time was taken in demonstration work. Babu K. C. Banerjee held charge for two months.

Receipts and Expenditure.

	Rs.	A.	P.
Receipts—			
Sale-proceeds remitted to treasury	3,202	10	0
Bills outstanding	187	11	3
Valuation of stock in hand	1,210	8	0
Value of seeds supplied for distribution	503	0	0
Total ...	5,103	13	3
Expenditure—			
The total expenditure including experimental and capital charges on bullocks, etc., and laying out of plots ...	6,220	0	0

R. DAS GUPTA,

Offg. Deputy Director of Agriculture, Bengal,
Western Circle, in charge of Northern Circle.

ANNUAL REPORT OF THE BURDWAN FARM FOR THE YEAR 1918-19.

This farm is situated at a distance of about 4 miles south-east of the Civil Station of Burdwan. It was opened in the year 1885 and carried out only experimental work till the year 1911, when both the demonstration and experimental works were taken up.

It is now proposed to give up the experimental work entirely and carry out only the demonstration work from next year.

Area.

The area of the farm is 32 acres, of which about 30 acres are under cultivation.

Soil.

The soil is a poor sandy-loam. Below is a statement showing the analysis. The figures will show that the soil is poor in nitrogen, phosphoric acid and lime, but contains enough potash :—

	Soil 1st 9".	Sub-soil 2nd 9".
Insoluble silicate and sand	88·52	87·47
Ferric oxide	3·60	3·68
Alumina	4·42	5·27
Lime	·34	·33
Magnesia	·34	·31
Potash	·31	·32
Soda	·09	·07
Phosphoric Acid	·02	·03
Sulphuric Acid	·01	·01
Carbonic Acid	·04	·06
Organic matter and combined water ...	2·31	2·45
Total ...	100·00	100·00
Available Potash	·04	·02
Available Phosphoric Acid	·002	·001
Nirotgen	·011	·007

Irrigation and Drainage.

The Eden Canal which runs along the farm on the south of it affords ample facilities for irrigation, without which it would perhaps be impossible to grow crops like sugarcane, potato, and sometimes even paddy. On account of the close proximity of the canal and the slope of the ground the natural drainage of the farm is very good. During high-floods, however, the water in the canal rises above the farm level and it then becomes a source of trouble, as there is no other outlet for the water to pass away.

Season.

The total rainfall during the year under report exceeded by far the normal of the district, as will be found from the subjoined table, but its distribution was not even. The continuous heavy rainfall in August delayed

the transplantation of paddy and the total failure of rain in October and November was very unfavourable for the paddy crop in its maturing time :—

Name of the months.	Actual rainfall in inches during 1918-19.	Actual number of rainy days during 1918-19.	Normal rainfall of 40 years.	Rainy days of 40 years.
April 1918	4·28	5	2·20	3
May „	2·95	7	5·56	6
June „	21·98	24	10·70	12
July „	7·94	5	12·32	15½
August „	25·00	27	11·49	15
September „	6·26	10	8·59	11
October „	Nil	Nil	3·93	4
November „	Nil	Nil	0·64	¾
December „	·05	1	0·13	¼
January 1919	2·10	7	0·38	¾
February „	·95	1	0·89	1½
March „	0·41	2	1·24	1¾
Total ...	71·92	89	58·07	71½

Operations of the year—

(*1*) Experimental work.
(*2*) Distribution of seeds, manures, etc.
(*3*) Practical training of apprentices.

1. Experimental work with the following crops was taken up during the year :—

(*a*) Paddy. (*c*) Sugarcane. (*e*) Groundnuts.
(*b*) Jute. (*d*) Potato. (*f*) Cotton.

(*a*) **Paddy.**—(*i*) *Manures on paddy.*—The table below shows the different manures used and the yields obtained :—

Manures applied per acre.	Area in acres.	Cost of manures per acre.	Outturn per acre in lbs.	Value of outturn.
		Rs. A. P.	lbs.	Rs. A. P.
1. Bonemeal 3 maunds per acre ...	1·44	9 0 0	Grain 1,148	36 12 0
			Straw 2,114	3 4 0
2. Nitrate of Soda, 1 maund per acre	·32	12 8 0	Grain 1,476	47 4 0
			Straw 2,657	4 0 0
3. Green-manure with Dhaincha ...	1·38	2 1 9	Grain 1,251	40 0 0
			Straw 2,329	3 10 0
4. Unmanured ...	·6	Nil	Grain 599	20 5 6
			Straw 984	1 8 0

It appears that though the plot manured with nitrate of soda at the rate of one maund per acre gave the best outturn both in grain and straw, the Dhaincha green-manure is the most economical application for winter paddy.

Indrasail and Nagra were tried with a view to determine their comparative yield as against Dudkalma, the most popular transplanted winter paddy of the locality, but no successful results were obtained owing to the unfavourable weather.

(*b*) **Jute.**—followed by transplanted winter paddy :—During the year under report 1,066 lbs of paddy grain and 1,690 lbs. of straw were obtained per acre after a crop of 1,746 lbs. of jute. This is a very useful rotation where the jute can be sown by the end of April.

(*c*) **Sugarcane.**—The table below shows the results of manurial experiment with sugarcane from which it is clear that heavy manuring pays well in the cultivation of sugarcane.

Manures applied per acre.	Area sown in acre.	Actual outturn in lbs.	Outturn per acre in lbs.	Cost of manures per acre.	Value per acre.
		lbs.	lbs.	Rs. A. P.	Rs. A. P.
Two hundred maunds cowdung and 19 maunds castor cake	·5	1,823·5	3,647	82 0 0	378 0 7
Two hundred maunds cowdung and 9½ maunds castor cake	·5	1,626·5	3,253	53 8 0	337 3 9

(*d*) **Potato.**—Darjeeling potato was grown under different manures and it was found that the mixture of 15 maunds castor cake, 100 lbs. nitrate of soda and 200 maunds cowdung per acre gave the best results.

(*e*) and (*f*) Varietal demonstrations were made with groundnut and cotton, but both of them failed, owing to the heavy continuous rainfall in August.

2. **Distribution of Seeds.**—During the year under report about 75,000 cuttings of improved varieties of sugarcane were distributed among the cultivators of the Burdwan, Bankura and Birbhum districts. Each cultivator obtained 250 cuttings for trial, on condition of returning the same number of cuttings after the next harvest. The yellow Tanna variety of sugarcane, on account of its hardy nature, has already become very popular with the cultivators and the total output of sugarcane cuttings of the farm fell far short of the actual demand. Arrangements have, however, been made for extending the area under sugarcane during the coming year in order to meet the increased demand.

3. **Practical training of students.**—During the year under report only one apprentice received practical training in the farm.

Management.—The expenses of the farm are borne by the Hon'ble Maharajadhiraj Bahadur of Burdwan, to whom thanks are given. The entire management is in the hands of the Agricultural Department.

During the year under report four Superintendents, viz., Babus J. C. De, K. C. Pal, N. B. Mondal and P. N. Ganguly were, alternately, in charge of this farm and such frequent changes told heavily on its working.

5. A conference of the Divisional Agricultural Association, presided by the Divisional Commissioner, was held on the farm.

The Deputy Director of Agriculture, Western Circle, and the Superintendent of Agriculture, Burdwan Division, inspected the farm frequently. The Collector of Burdwan, who takes great interest in the working of the farm, visited it very often during the year :—

Receipt.

	Rs. A. P.
Receipt as opening balance	255 3 10
Burdwan Raj grant ...	2,500 0 0
Sale-proceeds of farm produce	2,485 2 6
Bills outstanding on 1st April 1919 ...	35 15 6
Value of stock in hand ...	262 8 0
	5,538 13 10

Expenditure

	Rs. A. P.
Establishment ...	730 0 0
Construction and repair	46 5 0
Implements ...	8 15 4
Wages of labourers ...	2,846 9 7
Cattle food ...	103 13 9
Contingencies ...	401 3 4
Seeds	109 15 9
Manures	500 11 6
Rent and taxes ...	36 7 9
Office expenses ...	20 1 3
Postage stamp ...	14 0 6
	4,818 3 9
Balance in hand	720 10 1
	5,538 13 10

R. DAS GUPTA,

Offg. Deputy Director of Agriculture,

Western Circle, Bengal.

ANNUAL REPORT OF THE DEMONSTRATION FARM, ST. ANDREW'S COLONIAL HOMES, KALIMPONG, FOR THE YEAR 1918-19.

Situation and History.—The village of Kalimpong is the headquarters of the subdivision of Daling (a Government estate of 4·01 square miles). The district was ceded to the British Government after the Bhutanese War of 1864-65.

Kalimpong has a fairly large bazar, and is the mart for the produce of a considerably large area. It is the centre of Tibetan trade with Bengal.

It is 11 miles by road from the nearest railway station, Kalimpong Road, a station on the Siliguri-Teesta Valley Extension of the Darjeeling-Himalayan Railway.

The Demonstration Farm is situated below the bazar on the easterly slope, which runs down to the Rilli river, a tributary of the Teesta, joining the latter at Riayng.

2. **Area and Elevation.**—This farm was started with 24 acres of land in 1907 by the Homes, but the area has now increased to 70·96 acres, of which 9·75 acres are utilised for roads, cooly houses, and farm buildings with some waste lands and plots growing trees and bamboos, leaving 61·21 acres for cultivation.

The elevation is as follows :—

	Ft.
Lower boundary	3,317
Farm buildings	3,673
Upper boundary	3,864

3. **Irrigation.**—The only irrigation necessary for the paddy crops is obtained from the natural rainfall, and this consists of turning the water out of the many streams on to the rice terraces, when required. For vegetable and fruit culture during the winter and dry season, irrigation is arranged through pipes from the natural springs, around which pucca stone vats have been built. These springs are situated in the heart of the farm and are never dry and supply the whole establishment with water.

4. **Character of the Soil.**—The soil is a rich clay-loam whose reaction is acid.

5. **Meteorology.**—The following table shows the normal rainfall for ten years and that of 1918 at the Demonstration Farm :—

Month.	Normal 10 years.		1918.	
	Rainfall.	Rainy days.	Rainfall.	Rainy days.
1918.	Inches.		Inches.	
January	0·27	1	...	...
February	1·04	4	·62	4
March	1·75	5	2·46	8
April	2 62	10	5·32	11
May	5·67	17	5·11	17
June	21·49	22	21·98	26
July	26·19	27	24·61	29
August	21·79	25	23·17	27
September	11·34	18	14·24	21
October	4·14	6	·17	3
November	1·29	2	·01	1
December	·37	1	...	...
Total ...	97·96	138	97·69	147
1919.				
January	...	...	·57	2
February	...	...	1·01	5
March	...	...	·73	3

From the above figures it will be noticed that the season was favourable for the maize and paddy crops from the very commencement, but the absence of sufficient rainfall during October and November ruined practically all the secondary crops, such as buckwheat, soybeans, dal and Marwa.

6. **Operations during the year.**—(*a*) **General Crops grown.**—The following table gives the area under each crop grown by the farm and on the half-crop system, with the total outturn, yield per acre, cost of cultivation, price per maund (82 lbs.) and total value of crops :—

Crops.	Area in acres.	Outturn in lbs.	Yield per acre in lbs.	Cost of cultivation per acre.	Price per maund (82 lbs).	Total value of crops.	Grand Total.
				Rs. A.	Rs. A.	Rs. A. P.	Rs. A. P.
Maize	23	52,808	2,296	39 0	3 0	1,932 0 0	2,161 8 0
Half crop maize ...	9·50	6,621	697	...	3 0	229 8 0	
Paddy (aman) ...	14·25	20,981	1,472	43 0	3 4	831 9 6	1,223 10 3
Do. straw ...	14·25	33,439	2,346	...	0 11	365 8 3	
Half crop paddy ...	0·62	467	753	...	3 4	18 8 0	
Ditto straw ...	0·62	902	1,454	...	0 11	8 0 6	
Kodo (marwa) ...	6·25	13,120	2,099	48 0	3 4	520 0 0	666 4 0
Half crop Kodo ...	9·0	3,690	410	...	3 4	146 4 0	
Ghaiya aus paddy ...	·50	451	902	48 8	3 0	16 8 0	21 8 0
Do. straw ...	·50	3,280	6,560	...	0 2	5 0 0	
Buckwheat	2·0	624	312	15 0	4 0	30 10 0	...
Bhatmas (soybeans) ...	4·50	2,315	514	22 0	4 0	118 8 0	...
Gahat'	1·0	379	379	19 0	3 12	17 5 6	...
Dal kalai	2·0	1,106	553	23 0	5 8	74 4 0	...
Mashyem	2·0	922	461	21 0	4 0	45 0 0	...
Potatoes	1·50	3,187	2,124	98 0	4 0	155 8 0	...
Sugarcane	·75	4,120	5,494	132 0	8 0	405 0 0	...
Khar thatching grass ...	1·06	6,232	5,874	14 0	0 8	37 8 0	...
Fruit culture ...	6·50	...	...	33 0	...	1,060 4 9	...
Vegetable culture ...	2·15	...	...	250 0	...	1,227 0 6	...

From the above figures it is evident that maize and kodo, in rotation, are economically the most profitable crops for these hill sides. Kodo, buckwheat, soybeans, kalai dal and other pulses are grown after maize on the same land in one year, but none of the latter named crops is so popular as kodo. Ghaiya or aus paddy does well on open slopes, when sown in rows. Aman paddy is also cultivated on a profitable scale and good results can always be expected, if a sufficient supply of water from the *jhoras* is constantly diverted into the paddy areas till the second week of October. The other crops such as kalai dal, soybeans, mashyem and various kinds of pulses and buckwheat, etc., give unsatisfactory results and are not encouraging. Sugarcane, for manufacture of *gur*, also fruit and vegetable culture, are very profitable, and these need much improvement.

(*b*) **Experimental work.**—

Primary.

1. Maize.
2. Winter paddy (aman paddy).

Secondary.

3. Autumn paddy (aus paddy).
4. Kodo.
5. Buckwheat.
6. Soybeans and dals.
7. Sugarcane.
8. Miscellaneous, fruit and vegetable culture.

(1) **Zea mays—Maize—Makoi—Bhutta.**—Since 1907-08 experiments have been carried on, year after year, on this farm to improve the quality of the maize seeds and to retain a few selected and true to type varieties, which are likely to give good results everywhere in the district. After many years of experiments and special attention devoted to this work, we have now on the farm five varieties, *i.e.*, yellow round, yellow flat, white round, white flat and red round. These five varieties have been grown on large areas and we find the seeds are very true to type and heavy yielders. To enable us to retain these five types of maize varieties as true and heavy yielding we have annually two periods for selection for seed purpose, a preliminary one at the time of harvesting, when the crop is ready in August, and another in March, just before sowing the new crop, when the second or final selection is made here.

The average outturn of maize on 11 acres of all varieties under experimental cultivation for the past six years is here given—

	Mds. srs.		lbs.
1913-14	30 30	or	2,767
1914-15	30 39	„	2,539
1915-16	31 36	„	2,615
1916-17	31 28	„	2,599
1917-18	28 35	„	2,367
1918-19	29 10	„	2,398

The above figures speak for themselves showing the benefit derived from careful selection and preservation of seeds.

Seed was sown at the rate of 35 lbs. per acre between the third and fourth weeks of March and manure applied at the rate of 175 maunds or 14,350 lbs. per acre. The crop was harvested from the beginning of the second week to the end of August. The proportion of grain to cobs, with leaves attached, was 51·70 per cent.

(*a*) **Varieties.**—The variety experiment has given the following results for the last six years :—

Variety Experiment.

Varieties.		Outturn per acre.					
		1913.	1914.	1915.	1916.	1917.	1918.
Yellow round ...	Mds. ...	37¼	33¾	33⅜	29⅛	23	27
	lbs. ...	3,054	2,767	2,757	2,388	1,836	2,214
Yellow flat ...	Mds. ...	26¾	22	29	30⅜	26	29½
	lbs ...	2,203	1,804	2,378	2,490	2.132	2,419
White round ...	Mds. ...	33¼	37	35½	33⅞	34½	27½
	lbs. ...	2,726	3,034	2,911	2,777	3,075	2,234
White flat ...	Mds. ...	35	31¼	23¾	37¼	37½	32½
	lbs. ...	2,870	2,562	1,947	3,054	3,075	2,665
Red round ...	Mds. ...	30½	30½	36	32⅛	31.	31
	lbs. ...	2,561	2,561	2,952	2,634	2,542	2,542
Suttons' giant ...	Mds. ...	...	...	...	10¾	15¼	20
	lbs. ...	...	...	...	881	1,250	1,640

These figures are from one-acre blocks, and the figures backed up by the average from the farm require no comment.

(*b*) **Effects of terracing.**—To compare the result of growing ordinary crops (not irrigated paddy) on terraced and unterraced land, two acres were selected, as uniform in fertility and slope as was possible to find on the farm. One acre was terraced at a cost of Rs. 107-5-6. Each plot received similar treatment, equal amounts of manure and seeds being applied.

The following table shows the outturn and cost of cultivation of maize and secondary crops for the last six years.

Terraced *vs.* Unterraced Experiment.

Terraced acre.			Unterraced acre.		
Crop.	Outturn.	Cost of cultivation.	Crop.	Outturn.	Cost of cultivation.
1913-14.	lbs.	Rs. A. P.	1913-14.	lbs.	Rs. A. P.
Maize	2,460	37 10 0	Maize	2,911	37 10 0
Kalal dal—			Kalai dal—		
Grain	410	25 0 0	Grain	389	25 0 0
Straw	553		Straw	410	
1914-15.			1914-15.		
Maize	2,566	37 9 0	Maize	2,933	38 1 0
Buckwheat—			Buckwheat—		
Local	358	14 9 0	Local	369	14 9 0
1915-16.			1915-16.		
Maize	2,829	33 5 0	Maize	3,308	33 8 0
Soybeans—			Soybeans—		
Barmali ...	410	22 8 0	Barmali ...	287	22 0 0
1916-17.			1916-17.		
Maize	2,675	36 0 0	Maize	2,798	36 8 0
Kodo—			Kodo—		
Grains... ...	1,886	46 0 0	Grains	1,732	46 0 0
Straw estimated at Rs. 5.	...		Straw estimated at Rs. 5.	...	
1917-18.			1917-18.		
Maize	2,747	38 0 0	Maize	2,644	38 0 0
Dal kalai—			Dal kalai—		
Grain	481	23 0 0	Grain	502	23 0 0
Straw	984		Straw	1,025	
1918-19.			1918-19.		
Maize	2,644	36 4 0	Maize	2,419	36 2 0
Buckwheat—			Buckwheat—		
Local	307	15 4 0	Local	317	15 6 0

After eight years of experiments on these two areas we find that during these past two years the terraced acre has shown a marked improvement over the unterraced in the main crop, while it will be seen that the secondary crop has done better on the unterraced area.

(*c*) **Manurial Experiments.**—Three plots of ½ acre each have been reserved for this experiment since 1910-11. The condition of the soil in each plot is fairly uniform, and the situation of each plot is approximately at the same level. For the past eight years this manurial experiment has been continued and yearly the half acre with superphosphate, plus farm yard manure, has given the best results of the three.

It was therefore decided to give up applying all manures on these areas and to work these three half acres as unmanured areas for three or four years to find out how the crops are going to fare.

The following results were obtained last year and during the year under report with maize and marwa in rotation :—

½-acre plots.	Manure per acre.	Outturn of maize per acre.		Outturn of kodo per acre.	
		1917-18.	1918-19.	1917-18.	1918-19.
		lbs.	lbs.	lbs.	lbs.
1.	8,200 lbs. farm yard manure and 164 lbs. superphosphate ...	2,378	2,254	2,173	1,886
2.	8,200 lbs. farm yard manure ...	2,132	1,968	2,071	1,752
3.	Unmanured	1,640	1,558	1,660	1,472

From these figures it will be noticed that there is a marked decrease in yields in all three areas.

To test the value of nitrate of soda the following manurial experiment was undertaken with the results given below :—

		lbs.		lbs.	
1.	12,300 lbs. farm yard manure ...	2,460	maize	1,700	kodo.
2.	6,150 lbs. farm yard manure and 50 lbs. nitrate of soda ...	2,552	„	1,824	„
3.	Unmanured	1,569	„	1,627	„

The ordinary mule manure, which we purchase at Re. 1-11 per ton, is the most economical and effective.

The yellow round variety of maize is extensively cultivated and is a great favourite, being most profitable and popular with cultivators and merchants.

The white round is another favourite, and both these two varieties are made into maize meal or rice and eaten as porridge by the hill people as well as Europeans.

The red round is not cultivated much, although we find it one of our best yielders. There seems to be no market for it, and is chiefly given to poultry and animals.

The white and yellow flat varieties are very well known by the hill people to be heavy yielders, but as they get mildewed very easily only a few raiyats cultivate them in fairly large areas to sell the crop soon after harvesting. The thin ends of the cob usually open, and are also very accessible to weevils.

(2) **Oryza Sativa—Winter Paddy—Aman Dhan—Transplanted Paddy.**—Owing to the proximity of this farm to the hill ridge a very limited space is left to act as a collecting ground for water, and the crop in consequence is almost entirely dependant on the incidence of rainfall during these months to ensure that continuous supply of water which is so essential for its growth.

The seed-beds are sown by the third week of May, and transplanting commences by the end of June, and is completed by the end of July. The harvesting takes place soon after the first week of November and continues to the end of the month.

During the year under report three different kinds of experiments have been conducted with paddy, viz., (*a*) Elevation, (*b*) Variety and (*c*) Manurial.

(*a*) **Elevation.**—This experiment with touli variety of paddy has been undertaken since 1915-16 to show at what altitude paddy would do best on the farm and the surrounding hill sides.

Elevation Experiment.

Serial No.	Area in acres.	Approximate elevation.	Variety.	Outturn in grain and straw.	Yield per acre.	Cost of cultivation.
				lbs.	lbs.	Rs. A. P.
1	5·75	3,317—3,450′	Touli	8,815G / 12,976S	1,551G / 2,255S	230 0 0
2	3·0	3,550—3,650′	,,	4,674G / 7,585S	1,558G / 2,527S	114 8 0
3	2·33	3,500—3,700′	,,	3,157G / 5,453S	1,353G / 2,337S	98 8 0
4	0·87	3,775—3,800′	,,	1,045G / 2,234S	1,201G / 2,566S	34 12 0

During the past four years of this experiment it has been proved that the lowest elevation area has yielded the best results.

(*b*) **Variety.**—The following table shows the figures obtained for the last three years in connection with this experiment :—

Variety Experiment.

Variety.	Outturn per acre.					
	1916-17.		1917-18.		1918-19.	
	Grains.	Straw.	Grains.	Straw.	Grains.	Straw.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Touli	1,720	2,378	1,394	2,624	1,435	2,952
Dhanasi	1,148	2,870	1,476	2,870	1,066	2,542
Mansura	1,392	2,460	1,558	2,952	1,599	3,034
Ratomarsi	1,064	2,624	1,230	2,788	1,558	2,870
Timurah	1,064	2,706	1,189	2,788	1,312	2,706
Ramtulsi	1,188	2,952	1,025	2,788	1,271	2,624

From the above figures is it difficult to judge which is the best yielder? Some varieties require plenty of irrigation and ripen earlier, while others don't, and when the rainfall is heavy or light, as the case may be, the varieties either suffer or give good outturns. On the whole touli seems to be slightly the best and this is cultivated chiefly on the farm.

(*c*) **Manurial.**—During the past nine years an experiment has been conducted to note the effects of green-manuring, as compared with farm yard manure and an unmanured plot with touli variety of paddy.

The results of the last three years are here recorded :—

Manurial Experiment.

Manure.	Outturn per acre.					
	1916-17.		1917-18.		1918-19.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1. Unmanured ...	1,199	1,845	1,230	2,706	1,291	2,583
2. 4,100 lbs farm yard manure.	984	2,214	953	2,952	984	3,075
3. Green manured (soybeans).	1,322	2,091	1,445	2,583	1,414	2,767

From these figures there does not appear to be any advantage from farm yard manuring. Unmanured and green manured areas have always given better results. It is never the practice to manure paddy areas on these hill-sides, as the washings, etc., from above reach unmanured fields from the *jhoras*.

(3) **Oryza Sativa—Autumn Paddy—Aus Dhan or Ghaiyas—Unirrigated paddy.**—This crop is usually sown broadcast on slopes thoroughly exposed to wind, air and well-drained. On the farm it is sown in rows at 18″ seeds dibbled in at 8″ apart.

The results of the last three years are given below :—

		Grain.	Straw.
1916-17	1 acre plot	1,830	8,745
1917-18	1 „ „	738	6,988
1918-19	1 „ „	902	6,560

There has been a marked decrease in the returns due to unfavourable weather at the time of sowing, and at the ripening stage. At the same time it has been noticed that a good percentage of the crop is lost at the time of harvesting, due to the grains shedding so very freely. This year again the crop was cultivated at a loss of Rs. 6 per acre.

(4) **Eleusine Coracana—Millet—Marwa—Kodo.**—This crop grows in rotation with maize and is transplanted from the third week in June to the end of July, so that when the maize crop is harvested in August the kodo covers the land, having well developed in the interval.

The following table shows the average outturn per acre from 1913-1918 from 6 acres of land under marwa cultivated by the farm :—

Marwa outturn for 6 years.

	lbs.
1913	2,255
1914	1,886
1915	1,909
1916	1,640
1917	1,790
1918	2,099

During the past four years an experiment has been conducted to test the yield of two varieties, the curly closed and the open loose varieties of the

marwa cultivated extensively on these hills, and the results obtained are as follows :—

Marwa variety experiment.

Year.	Variety.	Area in acres.	Outturn.	Cost of cultivation.	Value of crop.
			lbs.	Rs. A.	Rs. A.
1915-16 ...	Curly closed ...	1	1,763	43 8	80 4
	Open loose ...	1	1,906	47 0	86 6
1916-17 ...	Curly closed ...	1	1,804	45 0	65 8
	Open loose ...	1	1,937	47 8	70 0
1917-18 ...	Curly closed ...	1	1,829	48 8	56 9
	Open loose ...	1	1,908	49 0	60 0
1918-19 ...	Curly closed ...	1	1,906	49 0	80 9
	Open loose ...	1	2,009	49 8	84 10

The open loose variety has so far given the best results, in spite of its shedding a good percentage of its grains at the time of harvesting.

The straw is estimated at Rs. 5 per acre and this is used for grazing. The grains were sold this year at Rs. 3-4 a maund, early in March 1919, which is very reasonable for marwa.

(5) **Fagopyrum Esculentum—Buckwheat—Phaphar.**—This crop is grown in rotation after maize. Seed is sown in the beginning of September and is ready for harvesting by the end of November. Two acres were put under this, and due to no rainfall in October and November, at the time when the crop was in full blossom, the whole crop more or less was a failure, the returns being very poor.

(6) **Leguminous crops.**—The following crops belonging to this order are grown in this district and on this farm :—

Botanical name.	English name.	Nepali name.	Number of varieties.	Remarks.
Glysine hispida ...	Soybean ...	Bhatmas	5	Lepcha name Silliyan.
Phaseolus Mungo ...	Dal ...	Dal kalai	2	
Ditto Calcaratus ...	„ ...	Mashyem	3	
Ditto Sublobatus ...	„ ...	Ditto ...	1	This species is often called Gyrans.
Dolichos Biflorus ...	„ ...	Gahat ...	1	

(*a*) **Soybeans.—Glysine hispida.**—The following varieties were grown on the farm on 1 acre plots, and figures for the past six years are given below :—

Soybeans.

Variety.	Area in acres.	1913-14.	1914-15.	1915-16.	1916-17.	1917-18.	1918-19.	Remarks.
		Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Nepali Bhatmas	1	1,353	1,681	820	1,148	902	1,148	Whole season crop grows alone.
Bermali „	1	1,066	697	410	861	543	430	
Green „	1	1,066	729	164	922	410	313	Grown in rotation with maize.
Chocolate „	1	1,189	799	635	820	656	522	
Black „	1	922	676	440	984	797	635	

The first two varieties are erect growing, while the last three mentioned are of trailing habits.

All these leguminous crops can be grown in rotation with maize. However, Nepali soybeans produce very little when grown along with maize, but when grown alone yield heavily. They cannot, however, compete with maize or marwa. The cost of cultivation of these crops was Rs. 22 per acre, except the Nepali variety; when grown alone in the open, cost Rs. 40 per acre. The value of the Nepali soybeans was Rs. 5 per maund (82 lbs.), and of the other varieties at Rs. 4 per maund.

(*b*) **Kalai Dal (Phaseolus Mungo).**—Two acres were again grown with this crop and an outturn of 1,106 lbs. of grain was obtained, that is at 553 lbs. per acre. There is a great market for this *dal* and the price usually varies from Rs. 5 to Rs 6 per maund. The cultivators usually sow this crop on the ridges or ails of paddy-fields.

(*c*) **Mashyem Dal (Phaseolus Calcaratus)—Phaseolus Sublobatus.**—An area of 2 acres was cultivated with three varieties of this crop and an outturn of 461 lbs. per acre was obtained, in spite of no rains at the time when the crop needed some moisture very badly.

(*d*) **Gahat (Dolichos Biflorus).**—An area of 1 acre was cultivated under this crop and an outturn of 379 lbs. of grains was obtained at a cost of Rs. 19. The grain was sold at Rs. 3-12 per maund (82 lbs.). This grain after it is boiled is said to be given as food to people suffering from small-pox. The rash, it is further said, comes out of the body quickly and the patient is well in a very short time. During the last year there was a great demand for this gram on the farm, due to the outbreak of small-pox in the district.

(7) **Sugarcane (Saccharum Officinarum).**—This crop takes 18 months to come to maturity on these hills, as compared with 10 months on the plains. In April 1916 a terraced area of ·50 acre was planted with this crop, and was increased by ·25 acre in April 1917. From this area of ·75 acre an outturn of 50 maunds 10 seers (4,120 lbs.) of *gur* was manufactured or 5,494 lbs. of *gur* per acre, and this was sold at Rs. 7 to Rs. 10 per maund. The cultivation expenses incurred during the year was Rs. 98-12, while the total receipts were Rs. 405, giving us a clear profit of Rs. 306-4 per acre.

(8) (*a*) **Potatoes (Solanum tuberosum).**—An area of 2 acres was planted with this crop with an outturn of 38 maunds 35 seers or 3,187 lbs. This was cultivated at a loss of Rs. 25 per acre, more or less due to the dry weather we have experienced since October till the time of harvesting at the end of March and to the absence of any source of irrigation.

(*b*) **Fruit culture.**—Special care is now devoted to this section of our work and an area of 6·50 acres (of which 3·02 is under the Darjeeling Improvement Fund for supply of graftings, cutting, etc., etc., to the cultivators in this district free of costs) is being cultivated with various kinds of fruit trees, such as local and Australian Navel oranges, numerous varieties of limes and lemon peaches, plums, apples, apricots, pineapples, loquats, pomegranates, cherries, bananas, tree tomatoes, grenadillas (passion flower fruit) and grape vines.

We have tried English fruit trees, but find they do not thrive at our elevation of 3,650 feet. A few Japanese and Australian fruit trees are being experimented with, and we have every hope of these succeeding.

Pineapples.—An experimental area of ½ an acre under pineapples of the "Queen" variety was planted in September 1912-13. The following results have been obtained during the past seven years, since the time of planting t o date :—

Pineapples.

Year.	Cultivation expenses.	Outturn in pines and price.	Value.
	Rs. A.	A. P.	Rs. A.
1912-13 and 1913-14 ...	102 10	54 at 2 6	8 7
1914-15 ...	27 4	497 at 2 0	62 2
1915-16 ...	31 0	1,002 at 2 0	125 4
1916-17 ...	35 [illegible]	2,700 at 2 0	337 8
1917-18 ...	44 [illegible]	3,570 at 2 0	446 4
1918-19 ...	54 0	4,260 at 10 for Re. 1	426 0
Total ...	293 14	12,083	1,405 9

After deducting all expenses a profit of Rs. 1,111-7 is shown in seven years. In the year under report it has been noticed that the quality of the fruit from this area has begun to deteriorate and the sizes of fruits harvested have not been half the size they used to be in the earlier years. The growth in the plants here makes cultivation difficult and in another year or two the whole area will have to be uprooted and replanted, as there is barely any walking space between the rows of suckers.

From sale of fruits this year, including pineapples, a sum of Rs. 1,060-4-9 was realised at a cost of Rs. 214-8, giving a substantial profit of Rs. 845-12-9.

(*c*) **Vegetable cultivation.**—During the year under report 2·25 acres were placed under this experiment and practically all varieties of European and Indian vegetables were cultivated at their respective seasons. Everything has been grown with more or less success and a sum of Rs. 1,229-0-6 was received from the sale of these vegetables. The cultivation expenses, including the price of seeds and cost of manure appliedf or the 2·25 acres, was Rs. 574. Our chief market has been Kalimpong although a large quantity was sent to the Tista Bridge bazar in the winter months.

In addition and apart from the above-stated sale-proceeds, 1,066 lbs. of maize plus 1,875 lbs. of potatoes were also harvested from the same area during the year under report. Our object in taking up this cultivation on the farm is to introduce it amongst the ryots of the Government estate, and to put them in the way of exporting their produce to Calcutta at suitable times as well as to provide for the needs of the coming hill station.

The following vegetable seedlings were sold to the public in the year under report :—

Cabbages,	5 varieties	2,675	at As. 12 per 100 plants.
Cauliflowers,	3 „	3,100	„ 12 „
Knolkholes,	2 „	500	„ 8 „
Sikkim Pea seeds		10 lbs.	„ 12 per lb.
Jerusalem Artichoke tubers		5 seers.	

To attain our object I find that the simplest and best method of inducing the cultivators to grow foreign vegetables is to raise a large quantity of seedlings, and to sell these at reasonable rates.

An experiment has been undertaken on half an acre of land with three varieties of tobacco ; so far no results can be given, as the crop, which promises to be fair, is still not yet ready for harvesting. The crop was sown late, consequently the delay in coming to maturity.

(*d*) **Receipts and expenditure.**—A copy of the balance sheet for the year ending 31st March 1919 is given below :—

RECEIPTS.

	Rs.	A.	P.
Balance from 1917-18	9	14	9
Government grant, 1917-18	5,000	0	0
Sale of Farm produce	6,608	8	0
Miscellaneous receipts	475	14	3
Bullocks	367	0	0
Total	12,461	5	0

EXPENDITURE.

	Rs.	A.	P.	Rs.	A.	P.
Labour	3,545	6	3			
Superintendence	2,660	10	0			
				6,206	0	3
Miscellaneous, seeds, manures, repairs, postage, etc.				1,481	4	9
Bullocks				419	0	0
Implements				89	1	6
Capital outlay				900	0	0
Half crop to Homes				3,304	4	0
Insurance Policy renewal				31	10	0
Advertisement charges				21	5	0
Balance in hand				8	11	6
Total				12,461	5	0

The total value of produce sold shows an increase of Rs. 944-11-6 from that of last year. The increase is chiefly due to vegetables, fruits and sugarcane.

The wages bill for monthly and daily labour shows an increase of Rs. 412-15, due to terracing and improvements on the farm.

Capital Expenditure.—Another sum of Rs. 900 has been contributed to the Homes for purchase of the Manager's house with 7·05 acres of land which was acquired in 1916.

(*e*) **Training and practical demonstration.**—It has been our sole object to bring all our work more to the notice of the cultivators, and for the past five years much good has been done, through the kind help of Dr. Sutherland, who takes a keen interest in our work and is ever ready to bring his boys and masters of the Normal School for various lectures and practical demonstration, that are given from time to time in connection with maize seed selection, *gur*-making, etc. Misses Smith and Mackintosh of the Girls' School are also very keen and always bring their senior girls and teachers for lectures, etc. Mr. G. D. Pyne, our Magistrate, made the villagers come from places 7 or 8 miles distant from the farm, for the preliminary maize seed selection on the fields, at the time of harvesting in August. During the *gur*-making and final maize seed selection no ryots could be brought to the farm owing to an epidemic of small-pox all over the district.

(*f*) **Seeds and implements supplied.**—The following list of seeds, etc., were distributed during the year 1918-19 :—

	Mds.	srs.	or	lbs.
Maize	31	35	„	2,613
Paddy and ghaiya	4	5	„	338
Soybeans	4	20	„	369
Buckwheat	0	25	„	51
Dal	0	20	„	41

	No.
Orange gooties	462
Lime and lemon	37
Plantain hooks	29
Pineapple suckers	6,375
Sugarcane cuttings	1,010
Papayá seedlings	35
Grenadilla seedlings	12

Apart from this list of fruit trees supplied to the public there are various kinds of fruit seedlings, graftings, etc., supplied from the Darjeeling Improvement Funds Nursery, which is situated in the heart of the farm.

(*g*) **Management.**—I was the Manager in charge during the year. The land for the farm was bought by the St. Andrew's Colonial Homes, and is subject to an annual rental of Rs. 70-2-0. The farm is managed by the St. Andrew's Colonial Homes, and the Bengal Agricultural Department's grant of Rs. 5,000, plus half sale-proceeds, is sufficient to pay for the upkeep of the farm. The remaining half of the sale-proceeds is credited to the Homes.

The programme of work for this farm is drawn up by the Agricultural Department.

Inspection and visits.—The Hon'ble Mr. C. J. Stevenson-Moore, the Hon'ble Mr. J. G. Cumming, Mr. Samman, I.C.S., Commissioner, Rajshahi Division, Sir. Walter Buchanan, Mr. Ascoli, I.C.S., Secretary to the Board of Revenue, Mr. Swan, I.C.S., Deputy Commissioner, Darjeeling, and Mr. and Mrs. Howard, of Pusa, visited the farm.

Mr. Milligan, Director of Agriculture, Bengal, inspected the farm in October, while Mr. Smith, Deputy Director of Agriculture, Western Circle, inspected twice in June and in October and November.

H. R. EDMUNDS,

Manager, Demonstration Farm, Kalimpong.

REPORT ON WORK DONE FOR BENGAL BY THE MYCOLOGICAL SECTION, PUSA, DURING THE YEAR ENDING 31st MARCH 1919.

I.—By the Imperial Mycologist.

(*1*) *Ufra of Rice.*—An account of this disease was published during the year as a Memoir. Full details are given regarding the distribution of the disease so far as at present known, the life-history of the worm (Tylenchus anqustus) which causes it, and the methods of control that have been found satisfactory. Evidence is given, from recent work on the parasite, that its spread is likely to be limited to certain areas of high humidity and that much of the rice-growing tract in Bengal is likely to be either wholly unsuitable for its growth and multiplication, or suitable for so short a period of the year that serious damage is not likely to be caused.

(*2*) *Wilt disease of pigion-pea.*—The Imperial Mycologist is collaborating with the Fibre Expert in an investigation of the relationship between soil conditions and the incidence of the disease of *rahar* caused by *Fusarium udum*. Experiments to test the effect of different plant foods and stimulants were started at Pusa, both in field plots and pot cultures, and will be continued for several years. Results are not expected to be obtained for some time to come.

II.—By the 2nd Imperial Mycologist.

Black Band Disease of Jute.—During the later months of the rains in 1918 the Second Imperial Mycologist toured in Eastern Bengal and Bihar, in company with the Fibre Expert, and inspected the jute crop in these areas. The conclusion, reached in 1917, that late sown jute was relatively free from the attack of *diplodia corchori*, was established by the observations during the present season. The fact that the disease is almost restricted to jute plants which reach a certain stage of size and maturity was confirmed by counts made on the jute crop in Pusa, and by the observation that the disease does not appear until the season is well advanced. Field experiments were carried out in Pusa, but the abnormal monsoon of 1918 rather obscured the results. Fresh experiments are being laid down, in collaboration with the Fibre Expert, for the season 1919. One result of the exceptional dryness in September was the early ripening of the Pusa jute crop which was considerably less diseased than last year. Culture work and infections with the causal fungus were continued; the indications are that the fungus possesses a strong cytolytic enzyme. Corchorus Olitorius and red-stemmed varieties of Corchorus Capsularis seem to be free from the disease. The cause of this immunity will be studied during 1919.

The Bihar jute seed crop, amounting to nearly 1,000 maunds, was collected in Pusa and treated with a solution of copper sulphate before dispatch to Eastern Bengal.

ANNUAL REPORT OF THE ENTOMOLOGICAL COLLECTOR, BENGAL, FOR THE YEAR 1918-19.

During the year I spent 79 days on tour and visited the following places :—

May :—To Godenail (Naraingunge) to investigate the jute stem weevil (Apion sp.) and suggest remedial measures.

June :—To Naraingunge to investigate the red spider on jute (Tetranychus sp.) and Jute semilooper (Cosmophila sabulifera).

To Haldibari to investigate a betelnut disease with the Mycological Collector.

July :—To Godenail (Naraingunge) to investigate the palm beetle (Oryctes rhinoceros) and suggest remedial measures.

To Chinsura to investigate a jute weevil-pest.

August :—To Godenail to see the result of the treatment done to the palm tree on 17th July 1918.

To Pabna to attend the Exhibition.

September :—To Chinsura with Mr. Desspanda, Entomological Assistant. Konkan Division (Bombay), to investigate paddy pests.

To Godenail to investigate a Mehwa pest (Arbela sp.) and suggest remedial measures.

To Kurmitola (Dacca) to examine *Ufra* experimental plots.

October :—To Chinsurah to investigate the Rice Bug (Leptocorisa varicornis) and suggest remedial measures.

To Murel Farm (Jessore) to investigate a papaya disease.

To Kurmitola to examine the Ufra plots with the Mycological Collector.

To Naogaon (Rajshahi) to investigate a ganja pest (Agrotis sp.) and suggest remedial measures.

November :—To Baidya Bazar (Naraingunge) to investigate the army worm of rice (Leucania unipuncta).

To Godenail to investigate the cabbage caterpillar (Crocidolomia binotalis) on mustard and to spray the crop with lead chromate.

To Talat (Pabna) to investigate army worm of rice (Leucania unipuncta) and suggest remedial measures.

December :—To Lakhipassa (Jessore) to investigate army worm of rice and suggest preventive measures.

To Laksam (Chandpur) to investigate army worm of rice and suggest preventive measures.

January :—To Faridpur to attend the Exhibition.

February :—To Pusa to attend the Entomological Conference.

March :—To Banjetia (Berhampur) to attend the Exhibition.

The chief items of work are noted below :—

Observation and Treatment of Crop Pests.

The important pests observed on the Dacca Farm are the following :—

Large brown cricket (Brachytrypes achatinus).
Mango hopper (Idiocerus atkinsoni).
Mango-tree borer (Batocera rubra).
Mango weevil (Cryptorhynchus gravis).
Bullock's heart fruit-borer (Heterographis bengalella).
Jute hairy caterpillar (Diacrisia obliqua).
White ant (Termes sp.).
The lichi fruit borer (Argyropolce illepida).
Moth-borer (Diatraea sp.).
White moth-borer (Scirpophaga auriflua).
Jute semilooper (Cosmophila sabulifera).
Cotton bollworm (Earias fabia).
Cotton leaf roller (Dysdercus cingulatus).
Orange sann moth (Argina cribaria).

Spraying, hand-picking, fumigation, etc., were resorted to to check the ravages of the above insects where possible.

Sugarcane-borers.

A very careful selection of cane setts was made jointly with the Mycological Collector last year. Afterwards, the young borer-affected shoots were also destroyed as far as possible. As a result we had a good crop of cane much free from diseases and insect-pests this year.

This year also about 60,000 setts were selected, jointly with the Mycological Collector, for the next crop.

Jute Hairy Caterpillar.

The pest which was very bad in the last year was observed in small numbers on the Farm Jute as well as outside. The farm crop was cleared of the pest by hand-picking of eggs and young caterpillars. The ryot's crop in the vicinity was also examined and they were instructed to destroy the young caterpillars when found. In this connection a lantern-lecture was also delivered on the Dacca Farm.

The Mango Weevil.

The investigation of the pest was continued. A complete plate illustrating the life history has been drawn.

Exhibition.

In the Pabna, Faridpur, Dacca and Banjetia exhibitions the important crop-pests were shown and their life histories explained to the people. The use of entomological appliances was demonstrated and leaflets of some common pests were distributed.

Parcels.

A number of parcels of specimens were received and reported on.

Identification.

The following insect-pests were identified at Pusa :—

Argyropolce illepida.
Heterographis bengalella
Anomala varicolor.
Myllocorus discolor.
Ploecederus pedestris.
Epicauta waterhausei.
Idiocerus atkinsoni.
Tanymecus sciurus.
Glyphodes itysalis.
Diatraea sp.

Publication.

A note on the jute hairy caterpillar (Diacrisia obliqua) was written for the Agricultural Year-book.

P. C. SEN,
Entomological Collector.

ANNUAL REPORT OF THE MYCOLOGICAL COLLECTOR, BENGAL, FOR THE YEAR 1918-19.

I was on privilege leave for one month.

I spent 105 days on tour during the period under review and visited the following places in connection with outbreaks of fungus and *Ufra* or dak (eelworm) disease of paddy :—

Mymensingh	... ...	To investigate jute disease.
Rajshahi	... ...	Ditto ditto.
Rangpur	... ...	Ditto ditto.
Berhampur	... ...	To investigate mulberry disease, viz., Diplodia and Phyllactinia.
Khulna	... ...	To investigate areca palm disease.
Haldibari	... ...	Ditto ditto

Much time was also spent in supervising remedial measures for *Ufra* carried on in various centres, viz., Kurmitola, Pubail, Bikrampur, Gopalganj and Begumganj.

The result of the *Ufra* work is as follows :—

(*1*) *Kurmitola.*—The experiment in stubble-burning and seed selection conducted by the department in the previous two years was not repeated, but the owner was left to cultivate as he pleased.

The owner burned the stubble on the 3rd week of January 1918 and ploughed immediately after burning; disease-free seed was sown on the 20th February 1918.

Observation was taken at intervals by the Mycological Collector. About three-fourth crop was damaged by flood.

The rest of the crop was free from *Ufra.*

An outturn of about 4 maunds of paddy was harvested at the end of December 1918.

Khama Dhan.—Generally sown on a higher level than low-lying *beel*, was also grown along the border of this experimental area. This paddy was neither damaged by flood nor by *Ufra.*

There was also much less attack of *Ufra* in the vicinity, as much of the deep water paddy was damaged by flood.

(*2*) *Pubail.*—One block very notorious for *Ufra* was treated by burning stubble by the Department in 1916 and 1917. The disease appeared in both the years, but the extent of damage was slight. In 1918, the plot was treated by the owner, and local seed sown at the end of February 1918.

Ufra occurred at the end of July at first in four patches, which gradually spread, and finally about 4 annas crop was damaged. There was also a bad attack of *Ufra* in the vicinity.

At Pubail this plot has again been taken up this year to try *Digha Dhan*, in order to test its immunity as compared with the local paddy.

Boro (spring) paddy was also grown in another block, which was deepened and converted into *boro* type of land at the expense of Government in 1917, but it is to be regretted, that not a single ryot has since then followed this method. It is stated that this is not practicable in a big *beel* where no irrigation is possible.

(*3*) *Bikrampur.*—Out of 58 acres that were treated as a demonstration by the Department in 1917, only 3 acres that are directly in the hands of a local talukdar were treated this year. Stubble was burned in the middle of December 1917, and seed as in local practice, *i.e.*, mixture of *Aus* and *Aman* paddy or *Aus* or *Aman* alone, was sown immediately after ploughing in the middle of February 1918.

The crop was partially damaged by Kachoori (water hyacinth). The rest of the paddy was free from *Ufra.* There was also *Ufra* in the vicinity, but the extent of damage was small, probably due to flood.

(*4*) *Gopalganj.*—The crop was totally damaged by flood.

(*5*) *Begumganj.*—Two acres of land, treated by the Department for some time past have been returned to the owner. He has been following the same method as we did. Only one plot sown with the local mixture of *Aus* and *Aman* called *Bazal* has had an attack of *Ufra* and half the paddy was damaged. The adjoining untreated field was badly attacked with *Ufra.*

The intensity of the attack of *Ufra* at Begumganj, Shonaimuri and Lakhipura, in Noakhali district, was much greater than in the former two years.

Besides the above experiments, *Aus* paddy, being an early variety, in consequence of which it generally escapes the disease, was tried in some of the *beels* in Dacca and Faridpur districts, but the crop was totally damaged by flood.

As a matter of fact *Aus* paddy cannot be grown in very low-lying *beels* where *Ufra* is very bad, as only long-stemmed *Aman* is practicable.

A stubble-burning demonstration in two blocks (8 acres) in the Parjowar pargana, where *Ufra* was very bad during last year, has been started this year.

The following fungoid diseases have also been investigated :—

Rhizoctonia violacea on jute.
Diplodia sp. on jute.
Ditto on sida (Dacca Farm).
Ditto on sunn hemp (Dacca Farm).
Ditto on mulberry (Berhampur and Dacca Farm).
Ditto on custard apple (Dacca Farm).
Phyllactinia Corylea, on mulberry (Berhampur).
Accidium mori, on mulberry (Kurseong).
Nectria sp., on mulberry (Kurseong).
Colletotrichum falcatum, on sugarcane (Dacca Farm).
Rhizoctonia sp., on cow-pea (Dacca Farm).
Uromyces appendiculatus, on cow-pea (Dacca Farm).
Ustilagenoidea virens, on paddy (Dacca Farm).
Cercospora gossypiua, on cotton (Rangpur).
Uredo gossypii, on cotton (Dacca Farm).
Fusaruim sp., on cotton (Rangpur).
Peronospora parasitica, on cotton (Dacca Farm).
Erysiphe polygoni, on garden-pea (Dacca Farm).
Macrosporium solani, on tomato (Dacca).
Gleeosporium raciborskii P. henn, on mango (Dacca Farm).
Capnodium, on mango (Dacca Farm).

As routine work the Dacca Farm crops were kept under observation and remedial measures were resorted to where possible. All the jute plots on the farm were sprayed for Rhizoctonia and Diplodia, and mulberry plots for diplodia.

About a month was spent in selecting sugarcane setts on the Dacca Farm and treating with copper sulphate solution before planting.

This was done last year also, and the result was that sugarcane suffered much less from disease this season.

An article on Rhizoctonia of jute has been written for publication in the *Krishi amachar.*

The Mycological Collector attended exhibitions with show-cases of the various diseases of important crops of the province.

A. L. SOM,
Mycological Collector.

ANNUAL REPORT ON SERICULTURAL OPERATIONS, BENGAL, FOR THE YEAR 1918-19.

The general control and the usual management of the whole operations in Bengal continued in the hands of the Bengal Silk Committee, consisting of the Director of Agriculture, Bengal (President), with the Members, the Collectors of Malda and Murshidabad, Messrs. Malcolm, deMinvielle and Ariff.

During the year under review, the Committee held three meetings.

Administration.

I remained in charge during the year.

Disinfection of village rearing houses and raising seeds through the selected rearers.

The system of disinfection of village silk-worm seed-rearing houses, which was introduced by me in the year 1910, has been carried on with increasing success.

The popularity of the selected rearers' seed is increasing in the market and their seed has been sold during the year under report from Rs. 3-2 to Rs. 6-8 per kahon.

Tours.

I spent 314 days on tour and inspected the different nurseries as often as possible.

The points which specially engaged my attention were as follows :—

(1) The production and increase of disease-free seed from the central nurseries.

(2) The supervision of the production of disease-free seed by the selected professional rearers. Strict supervision is very necessary in order to prevent selected rearers from selling inferior seed. This year one rearer was struck off the list of selected rearers at Murshidabad and another in the Malda district. On the other hand a few new men were accepted.

(3) Comparison between the results obtained from the nursery seed with those obtained from the selected rearers' seed.

(4) To give the neighbours of selected rearers similar facilities for examining the silk-worms and cocoons as are provided in the Government nurseries.

(5) (*a*) To induce the passed sericultural students to work like the selected rearers in the production of disease-free seed and (*b*) to see that those receiving financial assistance work so far as is practicable according to the terms of their agreement.

(6) The thorough disinfection of the nursery houses and fittings as well as those of the selected rearers.

(7) The improvement of the mulberry lands attached to each of the central nurseries by manuring and good cultivation and thereby increasing the prolific growth of the mulberry plants for still more production of nursery seed as far as practicable. A sum of Rs. 7,284-10 during the year under review was spent on manures. Although much good has been done, this item ought to be considerably increased to bring the mulberry lands to first class condition.

(8) The extension in the area of mulberry lands.

(9) The planting of "selected" mulberry in the lands attached to the nurseries and the supply of cuttings to the ryots.

(10) The improvement of the ordinary village-rearing houses by adding ventilators and windows for light and air with a view to dry floors. Much, however, could not be done on this line owing to the scarcity and high price of wire gauze.

(11) The improvement of mulberry lands in the Birbhum district by a mixture of river sand with the heavy soil has proved a great success in the lands attached to the Kalitha Central Nursery and the practice is being introduced in surrounding village lands.

(12) The site of the Mirganj Central Nursery, which was started by the Eastern Bengal and Assam Government, is bad and this nursery has hitherto failed to produce mulberry in paying quantities. The question of its abolition was even considered. It is, however, proposed to attempt to improve the land by cutting broad drains and utilizing the excavation to raise the level of adjoining fields.

The present Condition of the Silk Industry in Bengal.

Since the year 1910 the market of the home-reeled silk has steadily risen, and owing to high prices in India, specially at Nagpur, Madras and Bombay, the silk-worm rearers of Bengal have profitted much. The improvement in

the industry has had the effect of increasing the area under mulberry as will be seen from the undermentioned statement of the census of mulberry in the districts of Malda, Rajshahi, Birbhum and Murshidabad up to the year 1918-19 made by the officers of the Sericultural Department on the same basis as the last census in 1913-14 :—

Names of districts.	Quantity of lands under mulberry in the year 1913-1914	Quantity of lands under mulberry in the year 1918-1919.	Quantity of lands under mulberry increased (+) and decreased (−) in the year 1918-1919.
	Acres.	Acres.	Acres.
Malda	13,770	18,113	+4,343
Rajshahi	332	149⅓	−182⅔*
Murshidabad	3,128	4,549*	+1,421
Birbhum	958	1,524	+566
Total ...	18,188	24,335⅓.	+6.147⅔ or 33 per cent.

*Newly planted 46½ acres during 1918-1919.

The average outturn per acre being about 360 kahons of cocoons the increased production amounts to about 2,200,000 kahons (1 kahon =1,280).

To supply seed-cocoons for the total annual requirements of the province about 87,000 kahons are required, of which we have actually supplied during the year under review 15,536 kahons directly from the nurseries. Through the selected professional rearers, who reared seed-cocoons by examining the moths (seed) at the nurseries under the direct supervision of the Superintendents, a further 6,000 kahons was supplied. Thus we have supplied about one-fourth quantity of the seed required for the crop in Bengal.

Nurseries.

The following is a list and description of the nurseries during the year :—

I.—Malda District.—(1) Piasbari Central Nursery, containing five large and one small (half size) rearing houses with 67 bighas and 4 cottahs of land of which 4 bighas contains "selected" mulberry planted 3 and 4 feet apart. This nursery contains many tanks and ponds from which the weeds (Bhodes) are used in heavy dressings as manure for mulberry lands. This nursery suffered a great deal from floods during the year. Almost all the houses were more or less damaged as a result of which rearing house No. 5, the store house and the Assistant's quarters have to be left out until they are thoroughly repaired. Much difficulty was felt and is still being felt for want of accommodation as all the houses have not yet been thoroughly repaired. In consideration of the above difficulties a portion of the work of keeping-up of Nistari seed and supply to other central nurseries has been transferred to Mirganj Central Nursery.

(2) Amriti Central Nursery, containing four large and two small rearing houses with mat walls, rears more seed during seasons favourable to the growth of mulberry. The production of mulberry is being increased by heavy dressings of castor-cake as far as funds permit, because cowdung manure is not available in sufficient quantity. The total area of the mulberry lands is 80 bighas 15 cottahs. Two hundred cuttings of the "selected" variety have been planted on the edge of the road side around the mulberry lands to grow as tree mulberry.

II.—Murshidabad District.—(3) Kumarpur Central Nursery, containing four rearing houses with 38 bighas 14 cottahs 7 chittaks and 3 gandas of mulberry lands of which 19 bighas have been planted with "selected" mulberry at 5 feet apart and 7 bighas have been planted at 2½ feet apart.

(4) Chandanpur Central Nursery, containing four rearing houses with 41 bighas 1 cottah and 4 chittaks of mulberry lands of which 18 bighas have been planted with "selected" mulberry of Punjabee variety at 4 and 5 feet apart.

III.—Birbhum District.—(5) Kalitha Central Nursery, containing four rearing houses with 52 bighas and 10 cottahs of land, of which 12 bighas have been planted with "selected" mulberry of the Punjabee variety at 3 to 5 feet apart.

The nursery being situated near the hills, the soil was hard and rocky but was much improved by dressing with river sand and by applying castor-cake manure to the lands. The lands can be further improved by heavily manuring the soil with castor-cake and river sand.

IV.—Rajshahi District.—(6) Mirganj Central Nursery, containing five rearing houses and 61 bighas and 16 cottahs and 8 chittaks of mulberry lands. The condition of the soil is very poor; as stated above it has been proposed to improve the condition of the same by digging broad drains to run off the rain-water and provide earth for raising the level of the mulberry lands.

Exchange of seed between the nurseries.

As usual, Piasbari Central Nursery supplied the Nistari seed-cocoons to all other central nurseries according to theis requisitions and Mirganj Central Nursery did the same in turn to the Piasbari and Amriti Central Nurseries.

The Bogra Nursery having been abolished the work of supply of the Deshi seed-cocoons has been transferred to the Kalitha Central Nursery during the year under report. The Deshi seed, thus supplied by the Kalitha Central Nursery to all other central nurseries, were all sold during last October to the professional rearers of all the silk districts in Bengal for their 1918 November crop, and had a most brilliant and splendid result, giving in turn to the rearers an outturn of 100 to 120 kahons from one kahon of seed.

Supply of pure and disease-free Nistari and Chotapoloo seed to the professional rearers.

The total receipts from the outturn of nurseries from 1st April 1918 to 31st March 1919 were as follows :—

K. P. G.		Rs.	A.	P.
From 15,536-13-9 seed-cocoons	...	59,556	13	0
„ 1,311-0-0 cocoons...	...	1,536	4	6
„ miscellaneous production	...	1,265	1	3
	Total ...	62,358	2	9

The figures of sale-proceeds for the three previous years are as follows :—

	Rs.	A.	P.
1915-16	16,828	8	4
1916-17	28,737	3	10
1917-18 (from 1st July 1917 to 31st March 1918) ...	32,562	9	6
1918-19	62,358	2	9

In comparison with the last three years' figures given above, it is remarkable that there has been a great increase both in revenue and production of good seed, which is mainly due to the success of Piasbari and Amriti Nurseries. These two nurseries situated in the district of Malda have produced about two-thirds of the total revenue during the year under report, and if more funds can possibly be provided in the budget, the management of other nurseries can be improved from a commercial point of view which will surely benefit the silk-worm rearers and the silk industry of Bengal.

The details of sale-proceeds of the outturn of each Central Nursery during the year commencing from 1st April 1918 to 31st March 1919 are shown below :—

Names of Nurseries.	Seed.	Cocoons.	Miscellaneous.	Total sale-proceeds.
	K. P. G.	K. P.	Rs. A P.	Rs. A. P.
Piasbari Nursery ...	5,008 0 0	143 0	310 4 0	23,796 12 9
Amriti ,, ...	3,559 0 0	166 4	85 1 6	15,191 4 3
Kumarpur ,, ...	2,135 9 0	275 0	228 5 0	6,853 7 6
Chandanpur ,, ...	1,450 0 0	598 0	365 2 3	6,543 3 9
Kalitha ,, ...	1,908 10 9	...	177 3 0	5,826 13 9
Mirganj ,, ...	1,475 10 0	128 12	47 14 0	4,095 5 3
Sadar ,, ...	.....	...	51 3 6	51 3 6
Total ...	15,536 13 9	1,311 0	1,265 1 3	62,358 2 9

The only way of doubling and tripling the production of nursery seed are (1) by extending the mulberry lands, (2) by further increasing the manuring of mulberry fields over what has been done during the year under report, if the funds be available in the next year's budget. (3) extending purchase of outside mulberry from the non-rearing classes and (4) construction of more rearing houses. There is one great difficulty which is felt for the present, viz., to keep up Nistari seed at the Piasbari Central Nursery to supply to all the central nurseries during the summer season, and at the same time to keep up Chotopoloo seed at Kalitha Central Nursery for supply to all the central nurseries ; during the cold weather I have to keep one rearing house entirely for this purpose. The want of this accommodation handicaps the production of examined seed.

Total expenditure of the nurseries, including the office establishment from 1st April 1918 to 31st March 1919, is as follows :—

Details.	Amount. Rs. A. P.
Salary of the Superintendent of Sericulture, Bengal ...	6,000 0 0
Pay of Establishment	18,701 7 8
Travelling allowance of the Superintendent of Sericulture, Bengal	2,143 7 0
Travelling allowance of the Establishment ...	4,044 9 3
Petty construction and repairs	7,224 9 0
Stipends	216 1 6
Rewards to nurserymen	410 0 0
Microscopes	450 0 3
Disinfection	2,369 14 9
Cultivation and rearing	47,289 9 6
Miscellaneous	13,198 9 0
Rates, rents and taxes	1,773 8 6
Total ...	1,03,821 12 5

Training of the sons of the professional rearers.

The principles of sericulture were taught to the professional rearers' sons at the Rajshahi Sericultural School whence nine students have successfully passed during the year. A lower primary school has been started at Piasbari for imparting improved scientific lessons to the rearers' sons attending the school.

Industrial Exhibitions.

Sericultural exhibits were shown at the Suri and Dacca Exhibitions where the Superintendent of Sericulture, Bengal, was present with the Director of Agriculture, Bengal.

Co-operative Credit Societies.

Under the supervision of the Superintendents of Piasbari, Amriti (Malda) and Kumarpur (Murshidabad) Central Nurseries several rural banks have been organised among the professional silk-worm rearers and they are named as :—(1) Piasbari Rindan Samity, (2) Modanpur Rearers' Co-operative Bank, (3) Bengal Grambashi Samity and (4) Kumarpur Joutha Bank, and they are highly spoken of by the inspecting staff of the Co-operative Department. I am trying to introduce more banks under the supervision of all the Nursery Superintendents with the help of the authorities of the department of the Registrar of Co-operative Societies, Bengal, to rid the professional silk-worm rearers, as far as practicable, from oppression by the mahajans (money lenders).

Figures received from the office of the Collector of Customs on the 12th March 1919. Raw silk exported to other countries from the Presidency of Bengal.

	lbs.	Value. Rs.
1913-14	52,961	4,65,055
1914-15	28,903	2,09,920
1915-16	23,837	2,06,400
1916-17	70,467	8,18,306
1917-18	44,303	5,26,640
1918-19 (11 months up to February)	49,291	8,00,860
Chhusum	173,283	2,13,740
Cocoons	3,750	6,827

A. C. GHOSE,

Superintendent of Sericulture, Bengal.

REPORT ON THE WORK DONE AT THE SERICULTURAL RESEARCH STATIONS (BERHAMPORE, KURSEONG AND KALIMPONG) DURING THE YEAR 1918-19.

Introduction.

Monsieur E. Grangeon started work on the improvement of the silk-worm races in December, 1913, the object being to evolve superior multivoltine hybrid races which would possess the various indigenous characteristics and at the same time yield more silk. In other words it has been the aim to produce hybrid races which would be more profitable to the silk rearers than the poor yielding indigenous races.

I need not dwell particularly on the history of the various races and the crossings effected by us in the course of our investigations during these years. These matters have been discussed at length in my previous reports.

The late Monsieur E. Grangeon.

Before dwelling on the report I must express the great loss which we have sustained owing to the death of Monsieur E. Grangeon who was killed in France on the 6th July 1918. Monsieur Grangeon was called away on military duties in August 1914 and was on service until he was killed. His death is a great loss to Bengal as the work he was doing gave promise of excellent results.

Generalisation.

Various crossings were made between the indigenous Nistari or Chotopoloo races and foreign superior races of silkworms. By constant and careful selection from these we have derived four principal types which promise well for the future.

Experimental *versus* **Field scale.**—Hitherto the races were reared on an experimental scale. But since March 1918, the most promising types are now reared on a field scale so as to avoid any chance of experimental errors.

Reeling figures.—The cocoons are reeled at the Rose Filatures Concern under the supervision of Mr. J. de Minvielle, Member, Bengal Silk Committee. This enables us to determine the exact capacity of each race as regards the yield of silk so as to study their commercial efficiency.

Figures for the quality of yarns.—Mr. M. N. McNamara, Director of Sericulture, Kashmir State, has also tested the silk yarns sent from these lots. We have therefore his figures regarding the quality of the yarns and also the reeling figures of Mr. J. de Minvielle. These will enable the reader to form a just comparison regarding the respective races as the figures have been received from the best authorities on the subject. I am much indebted to the above gentlemen for their kind help and many valuable suggestions.

Comparative statements.—Statements showing the comparative efficiency of each of these races are enclosed with this report.

Indigenous silk-worms *versus* **the hybrids.**—It will be seen from these statements that the indigenous races are far below the average in almost every respect. We had originally suggested the substitution of the hybrid types during the seasons from October to April, as the climatic conditions are extremely unfavourable for good results. It was suggested by Monsieur Grangeon that the Nistaris may be improved by selection and reared during the seasons from May to September. From the figures noted in the statements it will be seen that the hybrid types are not likely to give inferior results to the indigenous races even during the bad seasons. In our experiments in the hills at Kurseong and Kalimpong we have been able to note the improvement on the silk-worms reared there from March to October. If the stock races are kept in the hills during the bad seasons, any degeneration of the races can be avoided. For this purpose it is necessary that the hill work should be extended as soon as it is decided that the types are satisfactory. My grateful thanks are due to Rev. Dr. W. S. Sutherland of Kalimpong for his kind help and valuable instruction to me in my work.

The Hybrids.

J. 303 A, and J. 303 B, and No. 5.—The races J. 303 A and J. 303 B were kindly supplied by Miss M. L. Cleghorn, F.L.S., F.E.S., F.Z.S., and the race No. 5 was kindly supplied by Babu A. C. Ghose as his pure Madagascar stock to Mr. J. de Minvielle and thence sent to me for comparative rearing on a field scale. According to the decision of the Bengal Silk Committee all the races were reared under the same conditions.

No. 1 and No. 4.—The races Nos. 1 A and B as well as Nos. 4 A and B are from the research station and were evolved by Monsieur E. Grangeon and subsequently selected and reared under my supervision since his departure from India.

Reeling results.—From the reeling figures kindly supplied by Mr. de Minvielle, it will be noticed that the hybrids Nos. 1 and 4 are very superior yielders.

The yarn tests.—The quality of the hybrid thread is equal to that of the superior univoltine races. The indigenous races are far below the standard in this respect. It may be worth mentioning that the indigenous thread lacks in tenacity and elasticity and this is a great drawback in power-loom weaving. This is especially the case with warp threads which receive the greater strain.

The Tavelle test: its importance.—The figures for the tavelles require a little explanation as the exact significance of this process may not be known to others beyond the silk trading circles.

The object of the tavelles test is to determine the exact number of spindles which one worker can superintend on the throwing mill. If the thread breaks too often in winding it not merely gives inferior thread but at the same time entails heavier working costs.

The process consists in placing five hanks on the winding swifts and then running at the rate of 50 metres per minute on the take-up bobbin for two hours. The numbers of breakages during the time are carefully tabulated and the resultant divided into 800 gives the figures for the tavelles. The number of spindles one worker can superintend is thus determined.

Table showing the figures for the test on the quality of the yarns kindly supplied by Mr. M. N. McNamara, Director of Sericulture, Kashmir State.

Serial No.	No. on skeins.	Size.	Tavelles.	Average elasticity.	Average tenacity.
1	J. No. 303A	20 × 24	100	24·24	78·05
2	J. No. 303B	20 × 24	100	21·62	73·60
3	No. 1 A	20 × 24	100	22·47	70·05
4	No. 1 B	20 × 24	40	23·44	72·75
5	No. 4 A	20 × 24	80	21·37	76·30
6	No. 4 B	20 × 24	100	24·68	84·50
7	Nistari	20 × 24	40	21·58	62·50

It is seen that the hybrid threads are superior in all respects to those of the indigenous race. The figures for elasticity and tenacity in the former are almost equivalent to the best European races, especially in the cases of Nos. 4 B and J 303.

Observations.

Points for comparison.—I would like to draw special attention to the following columns in the comparative statements submitted in my report :—

(1) Kahon-parta per seer.
(2) Percentage of yield per laying.
(3) Number of layings, yielding one kahon outturn.
(4) Leaves consumed per kahon outturn.
(5) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr. de Minvielle's figures).

The yield of silk varies in different seasons.—It can be noticed after comparing the different statements of the different crops that the figures are not stationary in all cases. Each race does not show the same amount of yield in each crop. With the bush system of mulberry cultivation this is inevitable. But as the races have always been fed with the leaves from the same mulberry plots this does away with any possibility of error. So that the standard can be safely calculated from the figures shown in the statement.

Percentage of yield per laying.—This estimation is arrived at by calculating the percentage of the outturn of cocoons from one average laying for each race. This is very important for correctly ascertaining the resistance or the hardiness of a race.

Results very encouraging.—The cross races are at the 34th generation at present. As the types submitted to field trial are not showing any signs of degeneration there is every possibility of our being able to derive at least two good types which we may expect to issue as soon as further trials enable us to consider them as fixed. It needs no mention that in the experiment on hybridisation there are many difficulties. Our attempts hitherto have been very encouraging. But it cannot be considered safe to issue seeds without very strict trials. From the statements submitted it can be seen that we are subjecting each race to the strictest possible tests.

Pebrine.

In the columns on the percentage of diseases in the comparative statements, I have given the figures for the percentage of diseases.

Mud houses *versus* **Brick-built houses.**—The pebrine disease is the most redoubtable of all silk-worm diseases. It will be seen that the percentage of disease is also fluctuating. In one crop it shows less than in the others. This is due to the outward infection from the germs inside the rearing houses. The pebrine germ retains its infective power in the air for a considerable length of time. As the rearings are continued throughout the year in Bengal it is not possible to avoid them. Specially the thatched houses with mud walls cannot be efficaciously disinfected. To establish an exact value of the thatched *versus* the brick-built (pucca) houses the Bengal Silk Committee has recommended the building of a brick-built rearing house with every necessary arrangement of thorough disinfection. This trial will enable us to draw the correct conclusions regarding many important factors.

Mr. C. M. Hutchinson's method of Pebrine detection.

Since my last report I have had plenty of opportunities for studying Mr. Hutchinson's modified method and I am satisfied that it is superior to the old method. In the old system we used to take the resultant fluid of the whole moth and examine it under the microscope. Mr. Hutchinson suggested the examination of the gut because the disease is not always sufficiently developed to be visible in every part whereas it is always visible in the gut. I submit below the results of some of my examinations :—

Table showing the comparative efficiency of Mr. C. M. Hutchinson's method of gut examination and the old method (Mr. Pasteur's) of examination of the resultant fluid of the whole moth.

	First lot. (Examined on 27th June 1918.) (Same lot in both cases.)		Second lot. (Examined on 27th July 1918.) (Same lot in both cases).	
	Mr. Hutchinson's method.	Old method.	Mr. Hutchinson's method.	Old method.
Time required for examination ..	3 hours	3 hours	4 hours	4 hours.
Total number of moths examined by two men.	275	345	168	288
Age of the moths	4 days	4 days	7 days	7 days.
Percentage rejected for Pebrine ...	9 per cent.	3 per cent.	21 per cent.	10 per cent.
Percentage rejected for Flacherie ...	35 ,,	30 ,,	28 ,,	35 ,,
Moths too dried to be examined ...	Nil	Nil	30 ,,	14 ,,
Average number examined by one man in 1 hour.	46	57	42	72

From the above table it is seen that the examination of the gut gave better results in all cases. This is a very important step towards the elucidation of the pebrine problem. It clearly shows that in the old system we were leaving behind a good deal of diseased subjects at the time of the examination and thus endangering our crops as these undetected pebrinised layings were sure to infect the healthy worms during rearing. So by actual trials we have been led to assert the superiority of this modification of the old system.

It has been seen that the time required for the examination by the modified method is a little longer than by the older system. But this is of little importance when the greater efficiency of the modified method is taken into account. Moreover the disease can be detected at an earlier stage by Mr. Hutchinson's method which also appears to give a more accurate diagnosis of flacherie.

PRABHAT CHANDRA CHAUDHURI,
Superintendent of Sericulture, Berhampore, in charge Sericultural Researches.

STATEMENT I.

Data regarding different races of silkworms reared at the Berhampur Sericultural Research Station during March-April crop 1918.

Name of Race :	No. 1A, 28th generation.	No. 1B, 28th generation.	No. 4A, 28th generation.	No. 4B, 28th generation.	No. 4C, 28th generation.	Nistari.	J. 303A, 63rd generation.	J. 303B, 63rd generation.
1. Date of spinning of seed-cocoons.	6/9-2-18	7/11-2-18	5/10-2-18	5/10-2-18	5/10-2-18	3/5-2-18		
2. Date of cutting-out of moths.	23/27-2-18	21/25-2-18	13/16-2-18	18/22-2-18	20/24-2-18	14/16-2-18		
3. Date of examination of moths.	1/3-3-18	1/3-3-18	27/28-2-18	27-2-18 to 1-3-18	1-3-18	28-2-18 to 1-3-18		
4. Total number of moths	224	1,232	630	512	398	503		
5. Number of dead moths rejected.	32	155	50	50	26	16		
6. Total number of moths examined.	192	1,077	580	482	372	487		
7. Number of moths rejected for Pebrine.	1	11	5	2	5	23	Eggs were received from Miss Cleghorn.	
8. Number of moths rejected for Flacherie.	41	243	124	107	101	68		
9. Number of Disease-free moths.	150	823	451	373	266	396		
10. Number of improperly laid layings rejected.	Nil	Nil	Nil	Nil	Nil	Nil		
11. Number of layings rejected for univoltine tendencies.	Nil	Nil	Nil	Nil	Nil	Nil		
12. Temperature during seed-cutting period.	68°F. to 70°F.	68°F. to 70°F.	68°F. to 70°F.	68°F. to 70°F.	68°F. to 70°F.	68°F. to 70°F.		
13. Number of layings reared.	150	823	451	373	266	396	44	54
14. Average number of eggs per laying.	325	355	385	385	375	319	319	343
15 Date of hatching ...	5-3-18	4-3-18	1-3-18	1-3-18	3-3-18	2-3-18	16-3-18	16-3-18
16. Date of spinning ...	30-3-18 to 1-4-18	31-3-18 to 2-4-18	27/28-3-18	27/28-3-18	29/31-3-18	29/31-3-18	10/12-4-18	12/12-4-18
17. Temperature during rearing.	75 °F. to 82 °F.	75 °F. to 82 °F.	72 °F. to 80 °F.	72 °F. to 80 °F.	72 °F. to 80 °F.	75 °F. to 85 °F.	72 °F. to 84 °F.	72 °F. to 84 °F.
18. Total outturn of cocoons.	22 k. 12 p.	160 k. 10 p.	83 k. 8 p. 15 g.	79 k. 8 p. 14 g.	42 k. 9 p. 18 g.	72 k. 12 p.	5 k. 12 p. 13 g.	12 k. 13 p. 10 g.
19. Disposal of outturn :—								
(a) Quantity kept for seed.	1 k.	1 k.	1 k.	1 k.	Nil	1 k. 8 p.	14 p.	14 p.
(b) Quantity kept for sample.	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons.
(c) Quantity kept for reeling.	21 k. 10 p.	159 k. 8 p.	79 k. 14 p.	76 k. 4 p.	42 k. 4 p.	71 k. 2 p.	4 k. 12 p. 13 g.	11 k. 13 p. 10 g.
20 Total quantity of leaves used.	1,800 lbs.	12,217 lbs.	5,566 lbs.	5,305 lbs	2,569 lbs.	4,379 lbs.	640 lbs.	915 lbs.
21. Quantity of leaves rejected (tender, too hard, dusty, etc.).	160 lbs.	781 lbs.	240 lbs.	203 lbs.	94 lbs.	175 lbs.	52 lbs.	83 lbs.
22. Quantity of leaves consumed.	1,740 lbs.	11,436 lbs.	5,326 lbs.	5,102 lbs.	2,475 lbs.	4,204 lbs.	488 lbs.	922 lbs.

STATEMENT I—*concluded.*

Comparative figures for different races of silkworms reared at the Berhampore Sericultural Research Station during March-April crop 1918.

Name of Race :	No. 1A, 28th generation.	No. 1B, 28th generation.	No. 4A, 28th generation.	No. 4B, 28th generation.	No. 4C, 28th generation.	Nistari.	J. 303A, 63rd generation.	J. 303B, 63rd generation.
Mr. J. de Minvielle's reeling tests :—								
(*a*) Silk in 80 Sicca ...	2 srs. 2 ch.	15 srs. 12 ch.	7 srs.	7 srs.	4 srs. 1 ch.	5 srs. 12 ch.	7 ch.	12½ ch.
(*b*) Farai cocoons ...	20 k. 13 p.	156 k. 11 p. 6 g.	77 k.	72 k. 13 p.	49 k. 14 p.	74 k. 9 p. 14 g.	4 k. 7 p.	9 k. 12 p.
(*c*) Kahan parta per seer in 80 Sicca.	9 k. 12 p. 14 g.	9 k. 15 p. 4 g.	11 k.	10 k. 6 p. 8½ g.	12k. 4 p. 8¾ g.	12 k. 15 p. 12 g.	10 k. 2 p. 5½ g.	12 k. 7 p. 13½ g.
(*d*) Chassam or Fices ...	Total chassam of all races 10 srs. 12 chs.							
2. Comparative estimation :—								
(*a*) Percentage of dead moths.	14·2	12·6	7·9	5·8	6·5	3·1	Eggs were received from Miss Cleghorn.	
(*b*) Percentage of Pebrine.	·52	1·02	·86	·41	·07	4·7		
(*c*) Percentage of Flacherie.	21·3	22·5	21·3	22·2	27·1	13·9		
(*d*) Percentage of Disease-free moths.	78·1	76·3	78·8	77·5	71·8	81·3		
(*e*) Precentage of Yield per laying.	59·7 per cent.	70·4 per cent.	65·1 per cent.	72·7 per cent.	55·1 per cent.	73·6 per cent.	52·8 per cent.	74·8 per cent.
(*f*) No. of layings yielding one Kahon outturn.	6·5 layings.	5·1	5·4	4·7	6·2	5·4	7·6	5
(*g*) Leaves consumed per Kahon outturn.	75·5 lbs.	71 lbs.	64 lbs.	64·2 lbs.	58·3 lbs.	57·7 lbs.	81 lbs.	70 lbs.
(*h*) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr. de Minvielle's figures)	740 lbs.	710 lbs.	704 lbs.	673 lbs.	713 lbs.	749 lbs.	810 lbs.	873 lbs.
(*i*) Number of cocoons weighing one seer on the 3rd day after spinning.	960	960	1,040	1,040	1,120	1,130	1,120	1,280
(*j*) Average weight of one coccon (with chrysalis) on the 3rd day after spinning (200 readings).	11⅓ grs.	11 grs.	11½ grs.	11 grs.	10¾ grs.	9 grs.	9 grs.	8¾ grs.
(*k*) Average weight of silky substance in one coccon (without chrysalis) on the 3rd day after spinning (200 readings).	2 to 2½ grs.	2 to 2½ grs.	1½ to 2½ grs.	1¾ to 2½ grs.	1¼ to 2 grs.	¾ to 1 gr.	1½ to 1¾ grs.	1 to 1½ grs.
3. Variational features observed :—								
(*a*) Larval markings ...	All Nistari like worms except 36 worms without mark.	Nil	5 k. 12 g. without mark.			Nil	Nil	Nil
(*b*) Colour of Cocoons	Nil	Nil	2 k. 6 p. 15 g. of white cocoons, rest yellow.	2 k. 2 p. 14 g. of white cocoons, rest yellow.	5 k. 18 g. of white cocoons.	Nil	4 k. 7. p. 13 g. yellow, 1 k. 5 p. 10 g. white.	8 k. 8 p. 10 g. yellow, 4 k. 5 p. white.
(*c*) Any other features	.....	.....	.....	.....	.....	.....	Cocoons constricted like B. Mari, also others without constriction.	
4. Remarks ...	.....	In the table item No. 2 (h) it is mentioned that Miss Cleghorn's races are eating more leaves than others. As this was a small rearing with a few laying the figures cannot be said to be exact for higher rearings. The figures are very likely to go down for bigger rearings. Besides, the difference between the mulberry leaves with which they are fed in Calcutta might have been different to ours and it may require some generations under this condition to arrive at a difinite conclusion.						

STATEMENT II.

Data regarding different races of silkworms reared at the Berhampore Sericultural Research Station during April-May crop 1918.

Name of Race:	No. 1A, 29th generation.	No. 1B, 29th generation.	No. 4A, 29th generation.	No. 4B, 29th generation.	No. 4 sport, 28th generation.	Nistari.	J. 303A, 62nd generation.	J. 303B, 62nd generation.
1. Date of spinning of seed-cocoons.	2-4-18	2-4-18	28-3-18	28-3-18	27/29-3-18	30/31-3-18	11-4-18	11-4-18
2. Date of cutting-out of moths.	12-4-18	13-4-18	6-4-18	7-4-18	7-4-18	11-4-18	22-4-18	22-4-18
3. Date of examination of moths.	19-4-18	20-4-18	14/15-4-18	15-4-18	15-4-18	16-4-18	29-4-18	29-4-18
4. Total number of moths.	100	93	532	289	125	55	229	183
5. Number of dead moths rejected.	36	31	206	129	44	25	54	39
6. Total number of moths examined.	64	62	326	160	61	30	165	166
7. Number of moths rejected for Pebrine.	3	3	9	1	5	2	4	3
8. Number of moths rejected for Flacherie.	8	8	78	44	14	8	49	30
9. Number of Disease-free moths.	50	30	239	108	40	19	100	100
10. Number of improperly laid layings rejected.	5	Nil	Nil	7	2	1	12	15
11. Number of layings rejected for univoltine tendencies.	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
12. Temperature during seed-cutting period.	79°F. to 86°F.	79°F. to 86°F.	79°F. to 86°F.	79°F. to 86°F.	79°F. to 86°F.	79°F. to 86°F.	79°F. to 86°F.	79°F to 86°F.
13. Number of layings reared.	45	50	93	57	40	19	100	100
14. Average number of eggs per laying.	337	434	418	370	388	380	335	315
15. Date of hatching ...	21/22-4-18	22/23-4-18	15/16-4-18	17/19-4-18	16/17-4-18	17/18-4-18	30-4-18 to 2-5-18	30-4-18 to 2-5-18
16. Date of spinning ...	12/13-5-18	11/12-5-18	9-5-18	9-5-18	7-5-18	8/10-5-18	18-5-18	18/21-5-18
17. Temperature during rearing.	79°F. to 85°F.	79°F. to 85°F.	80°F. to 86°F.	80°F. to 86°F.	80°F. to 86°F.	80°F. to 86°F.	80°F. to 86°F.	80°F. to 86°F.
18. Total outturn of cocoons.	8 k. 12 p. 9 g.	13 k. 12 p. 10½ g.	22 k. 6 p. 11½ g.	10 k. 12 p. 16 g.	10 k. 7 p. 15 g.	5 k. 11 p. 12 g.	19 k. 13 p. 6 g.	19 k. 2 p. 7 g.
19. Disposal of outturn:—								
(a) Quantity kept for seed.	2k. 11p. 2 1/2 g.	2 k. 12 p.	2 k. 9 p. 14 g.	2 k. 10 p. 14 g.	2 k. 10 p. 3 g.	2 k.	4 k.	4 k.
(b) Quantity kept for sample.	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons
(c) Quantity kept for reeling.	5 k. 15 p. 6 1/2 g.	10k. 14p. 16 1/2 g.	19k. 10p. 17 1/2 g.	8 k. 2 g.	7 k. 11 p. 12 g.	2 k. 15 p. 17 g.	15 k. 11 p 6 g.	15 k. 7 g.
20. Total quantity of leaves used.	653 lbs.	891 lbs.	1,707 lbs.	839 lbs.	722 lbs.	399 lbs.	1,151 lbs.	1,103 lbs.
21. Quantity of leaves rejected (tender, too hard, dusty, etc.).	83 lbs.	97 lbs.	189 lbs.	110 lbs.	76 lbs.	35 lbs.	55 lbs	49 lbs.
22. Quantity of leaves consumed.	570 lbs.	799 lbs.	1518 lbs.	699 lbs.	646 lbs.	304 lbs.	1,096 lbs.	1,054 lbs.

STATEMENT II—*concluded.*

Comparative figures for different races of silkworms reared at the Berhampore Sericultural Research Station during April-May crop 1918.

Name of Race :	No. 1A, 29th generation.	No. 1B, 29th generation.	No. 4A, 29th generation.	No. 4B, 29th generation.	No. 4 sport, 28th generation.	Nistari.	J. 303A, 62nd Generation.	J. 303B, 62nd generation.
1. Mr. J. de Minvielle's reeling tests :—								
(*a*) Silk in 80 Sicca ...	13 chs.	1 sr. 4 $\frac{1}{2}$ chs.	1 sr. 10 chs.	8 chs.	11 $\frac{1}{2}$ chs.	3 $\frac{1}{2}$ chs.	1 sr.	15 chs.
(*b*) Farai cocoons ...	6 k.	10 k. 8 p.	19 k. 11 p. 18 g.	8 k. 7 p.	7 k. 8 p.	3 k. 2 p.	15 k.	15 k.
(*c*) Kahan parta per seer in 80 Sicca.	7 k. 6 p. 3 g.	8 k. 3 p. 2 $\frac{1}{4}$ g.	12 k. 2 p. 8 g.	14 k.	10 k. 7 p.	14k. 4p. 11 $\frac{1}{4}$ g.	15 k.	15k. 7p. 14 $\frac{3}{4}$ g.
2. Comparative estimation :—								
(*a*) Percentage of dead moths.	36	33·3	38·72	44·6	51·2	45·4	23·5	21·3
(*b*) Percentage of Pebrine.	4·6	4·8	2·76	·62	8·19	6·6	2·42	1·8
(*c*) Percentage of Flacherie.	12·5	12·9	23·9	27·5	20·9	26·6	29·6	18·07
(*d*) Percentage of Disease-free moths.	78·12	80·64	73·31	67·5	65·57	63·3	60·6	60·24
(*e*) Percentage of Yield per laying.	66·68	81·4	70·02	65·3	86·5	90·9	75·7	77·5
(*f*) No. of layings yielding one Kahon outturn.	5·1	3·62	4·3	5·3	3·8	3·8	5·05	5·2
(*g*) Leaves consumed per Kahon outturn.	64·9 lbs.	58·8 lbs.	67·7 lbs.	63·2 lbs.	61·6 lbs.	59·5 lbs.	55·2 lbs.	55·28 lbs.
(*h*) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr. de Minvielle's figures).	479 lbs.	481 lbs.	823 lbs.	984 lbs.	643 lbs.	850 lbs.	828 lbs.	853 lbs.
(*i*) Number of cocoons weighing one seer on the 3rd day after spinning.	830	820	808	800	816	1,283	1,392	1,300
(*j*) Average weight of one cocoon (with chrysalis) on the 3rd day after spinning (200 readings).	13·5 grs.	15·5 grs.	17·4 grs.	19·4 grs.	16·5 grs.	12·4 grs.	10·5 grs.	10·01 grs.
(*k*) Average weight of silky substance in one cocoon (without chrysalis) on the 3rd day after spinning (200 readings).	1·15 grs.	1·6 grs.	1·6 grs.	1·25 grs.	1·8 grs.	1·3 grs.	·82 grs.	·82 grs.
3. Variational features observed :—								
(*a*) Larval markings ...	Nil	Nil	Nil	Nil	2 p. 12 g. of Nistari like worms.	Nil	Nil	Nil
(*b*) Colour of Cocoons ...	Nil	Nil	2 p. 15 $\frac{1}{2}$ g. White Cocoons	Nil	Nil	Nil	Cocoons of two colours (yellow and whitish in proportion of 1 : 1).	

STATEMENT III.

Data regarding different races of silkworms reared at the Berhampore Sericultural Research Station during May-June crop 1918.

Name of Race :	No. 1A, 30th generation.	No. 1B, 30th generation.	No. 4A, 30th generation.	No. 4B, 30th generation.	J. 303A, 63rd generation.	J. 303B, 63rd generation.	Nistari.	No. 5 Ramnagar.
1. Date of spinning of seed-cocoons.	14-5-18	15-5-18	8-5-18	8-5-18	19-5-18	19-5-18	11-5-18	11-5-18
2. Date of cutting-out of moths.	24-5-18	23-5-18	17-5-18	17-5-18	28-5-18	28-5-18	20-5-18	21-5-18
3. Date of examination of moths.	28-5-18	30-5-18	23-5-18	23-5-18	4-6-18	4-6-18	26-5-18	28-5-18
4. Total number of moths.	1,321	1,046	1,669	925	1,706	1,925	852	207
5. Number of dead moths rejected.	634	508	243	216	1,091	1,132	115	36
6. Total number of moths examined.	637	498	1,326	645	567	739	636	171
7. Number of moths rejected for Pebrine.	25	11	21	20	24	28	45	11
8. Number of moths rejected for Flacherie.	242	238	898	498	154	223	475	40
9. Number of Disease-free moths.	362	256	429	232	373	493	198	80
10. Number of improperly laid layings rejected.	50	42	100	61	48	54	51	27
11. Number of layings rejected for univoltine tendencies.	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
12. Temperature during seed-cutting period.	84°F.	84°F.	85°F.	85°F.	86°F.	86°F.	85°F.	85°F.
13. Number of layings reared.	275	138	455	262	130	134	198	90
14. Average number of eggs per laying.	347	345	340	226	309	307	343	245
15. Date of hatching ...	1-6-18	1-6-18	25-5-18	26-5-18	6-6-18	6-6-18	29-5-18	29-5-18
16. Date of spinning ...	20-6-18	20-6-18	12-6-18	14-6-18	21-6-18	21-6-18	15-6-18	14-6-18
17. Temperature during rearing.	85°F.	85°F.	84°F.	84°F.	85°F.	85°F.	84°F.	83·5°F.
18. Total outturn of cocoons.	73 k. 10 p.	35 k. 2 p.	102 k. 2 p.	58 k. 10 p.	14 k. 10 p.	12 k. 10 p.	36 k. 10 p.	12 k. 4 p.
19. Disposal of outturn :—								
(a) Quantity kept for seed.	2 k.	2 k.	3 k.	2 k.	2 k.	2 k.	2 k.	3 k. 2 p.
(b) Quantity kept sample.	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons
(c) Quantity kept for reeling.	71 k. 8 p.	33 k.	99 k.	56 k.	12 k. 8 p.	10 k. 8 p.	34 k.	9 k.
20. Total quantity of leaves used.	6,282 lbs.	3,200 lbs.	8,000 lbs.	5,379 lbs.	1,512 lbs.	1,540 lbs.	2,725 lbs.	1,320 lbs.
21. Quantity of leaves rejected (tender, too hard, dusty, etc.).	370 lbs.	174 lbs.	384 lbs.	166 lbs.	68 lbs.	64 lbs.	102 lbs.	52 lbs.
22. Quantity of leaves consumed.	5,912 lbs.	3,026 lbs.	7,616 lbs.	5,213 lbs.	1,444 lbs.	1,476 lbs.	2,624 lbs.	1,263 lbs.

STATEMENT III—*concluded.*

Comparative figures for different races of silkworms reared at the Berhampore Sericultural Research Station during May-June crop 1918.

Name of Race:	No. 1A, 30th generation.	No. 1B, 30th generation.	No. 4A, 30th generation.	No. 4B, 30th generation.	J. 303A, 63rd generation.	J. 303B, 63rd generation.	Nistari.	No. 5 Ramnagar.
1. Mr. J. deMinvielle's reeling tests:—								
(*a*) Silk in 80 Sicca ...	6 srs. 12 ch.	2 srs. 15 ch.	7 srs. 9 ch.	4 srs. 5 ch.	6 ch.	2½ ch.	2 srs. 3 ch.	9½ ch.
(*b*) Farsi cocoons ...	71 k. 8 p.	33 k.	99 k.	55 k. 8 p.	12 k. 8 p.	10 k. 8 p.	34 k. 8 p.	9 k.
(*c*) Kahan parta per seer in 80 Sicca.	10 k. 9 p. 9½ g.	11 k. 3 p. 15 g.	13 k. 1 p. 7 g.	13 k. 1 p. 12½ g.	33 k. 5 p. 6½ g.	67 k. 3 p. 14 g.	15 k. 12 p. 6¾ g.	15 k. 2 p. 10½ g.
2. Comparative estimation:—								
(*a*) Percentage of dead moths.	48·14	48·37	14·5	23·35	63·95	58·8	13·49	17·39
(*b*) Percentage of Pebrine.	3·92	3·4	1·58	3·1	4·25	3·8	6·58	6·45
(*c*) Percentage of Flacherie.	38	47·8	67·87	77·2	25·33	30·17	69·24	23·39
(*d*) Percentage of Disease-free moths.	56·82	51·2	32·35	40·62	66·84	66·3	29·86.	52·63
(*e*) Percentage of Yield per laying.	98·56	97·1	84·65	87·11	46·6	39	68·8	71
(*f*) No. of layings yielding one Kahon outturn.	3·75	3·93	4·46	4·47	8·88	10·61	5·4	7·25
(*g*) Leaves consumed per Kahon outturn.	80 lbs.	86 lbs.	74 lbs.	88·87 lbs.	98·73 lbs.	116 lbs.	70·77 lbs.	102·98 lbs.
(*h*) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr. de Minvielle's figures).	927 lbs.	967 lbs.	973 lbs.	1,160 lbs.	3,259 lbs.	7,868 lbs.	1,108 lbs.	1,578 lbs.
(*i*) Number of cocoons weighing one seer on the 3rd day after spinning.	10 p.	11 p. 9 g.	11 p 19 g.	12 p. 4 g.	13 p. 10 g.	14 p. 3 g.	14 p. 5 g.	12 p.
(*j*) Average weight of one cocoon (with chrysalis) on the 3rd day after spinning (200 readings).	19·24 grs.	18·52 grs.	17·46 grs.	18·2 grs.	12·88 grs.	12·86 grs.	15·7 grs.	17 grs.
(*k*) Average weight of silky substance in one cocoon (without chrysalis) on the 3rd day after spinning (200 readings).	2·9 grs.	2·7 grs.	2·7 grs.	2·5 grs.	1·4 grs.	1·4 grs.	2·4 grs.	2·61 grs.
3. Variational features observed:—								
(*a*) Larval markings ...	.....	.....	.....	.....	.....	.....	.....	¾ of the worms with Nistari Mark and ¼ with Zebra mark.
(*b*) Colour of Cocoons ...	Yellow	Yellow	Yellow	Yellow	Cocoons of two colours: yellow and whitish.		Yellow	Cream colour.
4. Remarks	The reeling results have been very poor in some cases. No. 1 has preserved its superiority over others and although spun under the same condition the yield has not gone down so much in this case. Mr. J. deMinvielle's remarks are as follows:—"The poor results are due to the cocoons being weather-affected or Gazia."							

STATEMENT IV.

Data regarding different races of silkworms reared at Berhampur Sericultural Research Station during July crop 1918.

Name of Race :	No. 1A. 31st generation.	No. 1B. 31st generation.	No. 4A. 31st generation.	No. 4B. 31st generation.	J. 303A, 64th generation.	J. 303B, 64th generation.	No. 5 Ramnagar.	Nistari.
1. Date of spinning of seed cocoons.	21/22-6-18	21/22-6-18	14/15-6-18	15/16-6-18	22-6-18	22-6-18	17/18-6-18	17/18-6-18
2. Date of cutting-out of moths.	1/2-7-18	1/2-7-18	23/28-6-18	23/28-6-18	1/2-7-18	2-7-18	27/28-6-18	27/28-6-18
3. Date of examination of moths.	6-7-18	6/7-7-18	30-6-18	1-7-18	6/7-7-18	7-7-18	1/2-7-18	2-7-18
4. Total number of moths	979	1,171	2,385	931	740	781	1,284	879
5. Number of dead moths rejected.	610	802	1,432	628	511	476	925	607
6. Total number of moths examined.	265	290	822	223	167	243	283	235
7. Number of moths rejected for Pebrine.	9	12	30	12	12	13	19	15
8. Number of moths rejected for Flacherie.	51	112	289	39	98	80	63	45
9. Number of Disease-free moths.	236	176	503	172	57	150	201	175
10. Number of improperly laid layings rejected.	71	77	130	74	58	57	53	35
11. Number of layings rejected for uni-voltine tendencies.	2	2	2	5	4	5	25	1
12. Temperature during seed-cutting period.	85°F	85°F	85°F	85°F	85°F	85°F	85°F	85°F
13. Number of layings reared.	227	170	355	150	54	140	260	175
14. Average number of eggs per laying.	441	415	410	435	400	322	404	387
15. Date of hatching ...	9-7-18	9-7-18	2-7-18	3-7-18	10-7-18	10-7-18	5/6-7-18	5-7-18
16. Date of spinning ...	30/31-7-18	30/31-7-18	23/28-7-18	23/24-7-18	30/28-7-18	29/28-7-18	30/31-7-18	24/25-7-18
17. Temperature during rearing.	86°F	86°F	86°F	86°F	86°F	85°F	86°F	86°F
18. Total outturn of cocoons.	27 k. 10 p.	24 k. 12 p.	55 k. 14 p.	23 k. 14 p.	4 k. 6 p. 14 g.	6 k. 11 p. 19 g.	28 k. 12 p. 16 g.	25 k. 10 p.
19. Disposal of outturn— (a) Quantity kept for seed.	5 k.	5 k.	6 k. 9 p.	5 k. 10 p.	2 k. 3 p. 4 g.	2 k. 1 p. 19 g.	3 k. 14 p. 14 g.	3 k.
(b) Quantity kept for sample.	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons
(c) Quantity kept for reeling.	22 k. 8 p.	21 k. 10 p.	49 k. 3 p.	20 k. 2 p.	1 k. 15 p. 10 g.	4 k. 8 p.	24 k. 12 p. 2 g.	22 k. 8 p.
20. Total quantity of leaves used.	3,304 lbs.	2,835 lbs.	5,635 lbs.	2,469 lbs.	482 lbs.	882 lbs.	3,260 lbs.	2,068 lbs.
21. Quantity of leaves rejected (tender, too hard, dusty, etc.).	236 lbs.	170 lbs.	324 lbs.	162 lbs.	42 lbs.	49 lbs.	155 lbs.	103 lbs.
22. Quantity of leaves consumed.	3,068 lbs.	2,665 lbs.	5,311 lbs.	2,307 lbs.	440 lbs.	833 lbs.	3,105 lbs.	1,965 lbs.

STATEMENT IV—*concluded.*

Comparative figures for different races of silkworms reared at the Berhampore Sericultural Research Station during July crop 1918.

Name of Race :	No. 1A, 31st generation.	No. 1B, 31st generation.	No. 4A. 31st generation.	No. 4B, 31st generation.	J. 303A, 64th generation.	J. 303B, 64th generation.	No. 5 Ramnagar.	Nistari.
1. Mr. J. de Minvielle's reeling tests :—								
(*a*) Silk in 80 Sicca ...	2 srs. 7 chs.	1 sr. 15 chs.	5 srs. 14 chs.	1 sr. 15 chs.	$1\frac{1}{2}$ chs.	$5\frac{1}{2}$ chs.	1 sr. 12 chs.	1 sr. 9 chs.
(*b*) Farai cocoons ...	22 k. 3 p.	21 k. 10 p.	49 k. 3 p.	20 k. 2 p.	1 k. 15 p. 10 g.	4 k. 8 p	24 k. 12 p. 2 g.	22 k. 8 p.
(*c*) Kahan parta per seer in 80 Sicca.	9 k. 3 p. 14 g.	11 k. 2 p. $11\frac{1}{2}$ g.	8 k. 5 p. 13 g.	10 k. 6 p. $3\frac{3}{4}$ g.	21 k.	20 k. 9 p. $2\frac{3}{4}$ g.	14 k. 2 p. $6\frac{3}{4}$ g.	14 k. 6 p. 8 g.
2. Comparative estimation :—								
(*a*) Percentage of deed moths.	62·3	68·78	60	67·56	69	60·94	71·93	69
(*b*) Percentage of Pebrine.	3·39	4·13	3·64	5·38	7·18	5·35	7	6·38
(*c*) Percentage of Flacherie.	19·24	38·32	35·15	17·43	58·63	32·92	22·26	19·14
(*d*) Percentage Disease-free moths.	89	60	61 18	77·13	34·13	61·72	71	74·46
(*e*) Percentage of Yield per laying.	35·32	44·9	48·47	48·36	26·18	19·15	35	51
(*f*) Number of layings yielding one Kahon outturn.	8	6·86	6 35	6·28	12·22	20·14	9	6·82
(*g*) Leaves consumed per Kahon outturn.	111·51 lbs.	107·67 lbs.	95 lbs.	96·62 lbs.	99·15 lbs.	130·68 lbs.	107·76 lbs.	76·68 lbs.
(*h*) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr. de Minvielle's figures).	1,026·75 lbs.	1,190·37 lbs.	795·62 lbs.	996 lbs.	2,079 lbs.	2,673·12 lbs.	1,525 lbs.	1,092·5 lbs.
(*i*) Number of cocoons weighing one seer on the 3 d day after spinning.	10 p. 12 g.	10 p. 17 g.	12 p.	13 p. 4 g.	1 k.	1 k. 1 p.	12 p.	13 p.
(*j*) Average weight of one cocoon (with chrysalis) on the 3rd day after spinning (200 readings).	17·2 grs.	17·3 grs.	14 grs.	13·84 grs.	11·2 grs.	11·2 grs.	16·2 grs.	14·24 grs.
(*k*) Average weight of silky substance in one cocoon (without chrysalis) on the 3rd day after spinning (200 readings).	2·2 grs.	2·2 grs.	1·93 grs.	1·66 grs.	1·5 grs.	1·5 grs.	1·28 grs.	1·98 grs.
3. Variational features observed :—								
(*a*) Colour of cocoons ...	All yellow	All yellow	All yellow	All yellow	Yellow and whitish 1 : 1.	Yellow and white 1 : 1.	All cream colour	All yellow.
Kindly supplied by Mr. M. N. McNamara, Kashmir. — Average Elasticity.	22·47	23·44	21·57	24·63	24·24	21·62	.....	21·58
Kindly supplied by Mr. M. N. McNamara, Kashmir. — Average Tenacity.	70·05	72·75	76·38	84·50	75·05	73·60	.....	62·50

STATEMENT V.

Data regarding different races of silkworms reared at the Berhampore Sericultural Research Station during August-September crop 1918.

Name of Race :	No. 1A, 32nd generation.	No. 1B, 32nd generation.	No. 4A, 32nd generation.	No. 4B, 32nd generation.	J. 303A, 65th generation.	J. 303B, 65th generation.	No. 5 Ramnagar.	Nistari.
1. Date of spinning of seed-cocoons.	29/30-7-18	29/30-7-18	22/24-7-18	23/25-7-18	25/28-7-18	23/23-7-18	25-7-18	25-7-18
2. Date of cutting-out of moths.	1-8-18	1-8-18	31-7-18 to 3-8-18	1-8-18	1-8-18	1-8-18	3-8-18	3-8-18
3. Date of examination of moths.	10/12-8-18	10/12-8-18	6/8-8-18	7/8-8-18	8/9-8-18	8/9-8-18	8-8-18	7/8-8-18
4. Total number of moths	2,043	1,183	1,771	1,292	782	464	1,334	1,209
5. Number of dead moths rejected.	1,443	799	1,182	960	401	265	948	764
6. Total number of moths examined.	419	262	406	161	257	131	262	335
7. Number of moths rejected for Pebrine.	26	19	25	12	45	24	28	42
8. Number of moths rejected for Flacherie.	230	136	197	61	78	30	93	93
9. Number of Disease-free moths.	165	108	184	88	134	84	150	208
10. Number of improperly laid layings rejected.	181	122	179	167	102	68	126	101
11. Number of layings rejected for univoltine tendencies.	Nil	Nil	4	4	2	2	6	Nil
12. Temperature during seed cutting period	86°F	86°F	86°F	86°F	86°F	86°F	83°F	86°F
13. Number of layings reared.	165	106	176	84	134	64	150	200
14. Average number of eggs per laying	367	373	294	349	315	381	330	310
15. Date of hatching ...	15/17-8-18	16/17-8-18	9/10-8-18	9/11-8-18	12/13-8-18	15/15-8-18	11/12-8-18	11/12-8-18
16. Date of spinning ...	4/6-8-18	3/5-8-18	29/31-8-18	29/31-8-18	29/31-8-18	29/31-8-18	30-8-18 to 1-9-18	30-8-18 to 1-9-1
17. Temperature during rearing.	82°F	82°F	82°F	82°F	82°F	82°F	82°F	82°F
18. Total outturn of cocoons.	26k. 14 p.	21 k. 14 p.	22 k. 15 p.	18 k. 12 p.	11 k. 3 p. 4 g.	5 k. 15 p. 19 g.	16 k. 8 p. 14 g.	20 k. 2 p.
19. Disposal of outturn :—								
(a) Quantity kept for seed.	5 k.	3 k.	6 k. 9 p.	3 k. 10 p.	2 k. 5 p. 4 g.	2 k. 1 p. 19 g.	3 k. 14 p. 14 g.	3 k.
(b) Quantity kept for sample.	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons	2 pons
(c) Quantity kept for reeling.	23 k. 12 p.	18 k. 12 p.	26 k. 4 p.	15 k.	8 k. 12 p.	3 k. 12 p.	12 k. 8 p.	26 k.
20. Total quantity of leaves used.	2,607 lbs.	1,760 lbs.	2,498 lbs.	1,268 lbs.	906 lbs.	819 lbs.	1,609 lbs.	2,370 lbs.
21. Quantity of leaves rejected (tender, too hard, dusty, etc.).	237 lbs.	156 lbs.	202 lbs.	106 lbs.	60 lbs.	59 lbs.	107 lbs.	140 lbs.
22. Quantity of leaves consumed.	2,370 lbs	1,604 lbs.	2,296 lbs.	1,162 lbs.	846 lbs.	760 lbs.	1,402 lbs.	2,230 lbs.

STATEMENT V—*concluded.*

Comparative figures for different races of silkworms reared at the Berhampore Sericultural Research Station during August-September crop 1918.

Name of Race :	No. 1A, 32nd generation.	No. 1B, 32nd generation.	No. 4A, 32nd generation.	No. 4B, 32nd generation.	J.303A, 65th generation.	J.303B, 65th generation.	No. 5 Ramnagar.	Nistari.
1. Mr. J. de Minvielle's reeling tests :—								
(*a*) Silk in 80 Sicca ...	1 sr. 14 chs.	1 sr. 7 chs.	1 sr. 15 chs.	1 sr. 2 chs.	$4\frac{1}{2}$ chs.	2 chs.	$12\frac{1}{2}$ chs.	1 sr. $10\frac{1}{2}$ chs.
(*b*) Farai cocoons ...	23 k. 12 p.	18 k. 12 p.	26 k. 4 p.	15 k	8 k. 12 p.	3 k. 12 p.	12 k. 5 p.	26 k.
(*c*) Kahon parta per seer in 80 Sicca.	12 k. 10 p. $13\frac{1}{4}$ g.	13 k. $13\frac{1}{4}$ g.	13k 8 p. $15\frac{1}{4}$	13 k. 5 p. $6\frac{1}{2}$ g.	31 k. 1 p. $15\frac{1}{4}$ g.	30 k.	16 k.	15 k. 11 p. $3\frac{1}{4}$ g.
2. Comparative estimation :—								
(*a*) Percentage of dead moths.	70·83	67·54	62·69	74·3	52·62	57·32	70·46	63·66
(*b*) Percentage of Pebrine.	6·2	7·25	6·15	7·45	15·5	18·32	11	12·53
(*c*) Percentage of Flachorie.	54·89	51·52	48·52	37·88	30·35	22·9	31·67	27·76
(*d*) Percentage of Disease-free moths	38·9	41·22	45·32	54·65	52·14	48·65	50·22	59·7
(*e*) Percentage of Yield per laying.	61·78	89	60·79	81·88	33·96	51·48	42·77	60·12
(*f*) No. of layings yielding one kahon outturn.	5·64	4·84	5·34	4·48	11·96	11·67	6·83	6·86
(*g*) Leaves consumed per kahon outturn.	82 lbs.	73·32 lbs.	69·57 lbs.	61 lbs.	75·62 lbs.	126·66 lbs.	90·45 lbs.	89 lbs.
(*h*) Leaves required for cocoons to yield one seer reeled silk (calculated from Mr de Minvielle's figures).	1,035·25 lbs.	949 lbs.	931·5 lbs.	812 lbs.	2,329 lbs.	3,795 lbs.	1,448 lbs.	1,193·5 lbs.
(*i*) Number of cocoons weighing one seer on the 3rd day after spinning.	13 p 4 g.	13 p.	11 p.	12 p. 14 g.	15 p. 2 g.	13 p. 8 g.	12 p. 1 g.	13 p. 17 g.
(*j*) Average weight of one (cocoon with chrysalis) on the 3rd day after spinning (200 readings).	13·46 grs.	12·88 grs.	15·82 grs.	14·9 grs.	11·86 grs.	12·82 grs.	14 grs.	13·62 grs.
(*k*) Average weight of silky substance in one cocoon (without chrysalis) on the 3rd day after spinning (200 readings).	2·6 grs.	2·4 grs.	2·2 grs.	2·3 grs.	1·5 grs.	1·4 grs.	·2 grs.	2 grs.
3. Variational features observed :—								
(*a*) Larval markings ...	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
(*b*) Colour of Cocoons ...	Yellow	Yellow	Yellow	Yellow	Yellow and white.	Yellow and white.	Yellowish	Yellow.
4. Remarks	The yield in each case has gone down considerably. The weather throughout was very unfavourable.							

ANNUAL REPORT ON SCIENTIFIC WORK IN CONNECTION WITH SERICULTURE DONE BY MISS M. L. CLEGHORN, F.L.S., F.E.S., F.Z.S., FOR 1918-19.

The multivoltine hybrid race started in January 1911, by crossing a multivoltine Nistri female with a univoltine Italian-Japanese hybrid male, is now in its 70th generation and still continues to give good results.

The race has shown scarcely any variation in the size of its cocoon and multivoltine character for the last twenty generations, so although a cross-bred race, it may be considered pure bred with respect to these characters.

Tables I and II give the generations of races 303 and 329 reared from January 1918 to March 1919.

Cocoons produce 100-tavelle silk.—The size of the cocoons of the 303 race is small like that of a pure multivoltine race such as the Nistri race of India which produces about eight crops in the year. This hybrid race, however, besides producing ten crops in the year, has been found, when tested, to yield 100-tavelle silk like that of the best one-brooded races of Europe and Japan. The one-brooded races of Europe produce one crop of 100-tavelle silk during the year, whereas this hybrid race can produce many crops of 100-tavelle silk in the year. This compensates in a great measure for the fairly small size of the cocoon. The smallness of the cocoons of this race is due to a certain extent to in-breeding. It was reared on a very small scale from the first parental generation in December 1910 to the thirty-eighth filial generation in August 1915, and it has not yet been re-crossed with a strain of the same stock reared in a different locality although now in its seventieth filial generation. It is, however, a many-brooded vigorous race with small cocoons yielding superior silk, and such a race is suitable to the requirements of India. Mukerjee states in his Hand-book on Sericulture written many years ago before cross-breeding experiments were carried out on a large scale, that "there is very little hope of Bengal silk ever coming to be recognised as 100-tavelle silk." He was naturally of the opinion that the many-brooded characteristic would be inherited along with that for producing inferior silk.

Inferior silks break frequently when being wound and are technically known as 20-30, and 40-tavelle silks. The quality of the silk as regards winding is expressed in tavelles. Ten skeins of silk which have no breaks in an hour's winding is technically known as 100-tavelle silk. As the average operator can join 80 breaks in an hour when controlling the winding of 100-skeins, should there be 8 breaks when 10 skeins are being wound, there would be about 80 breaks when 100 skeins are being wound, so a girl could control 100 swifts or tavelles of that silk.

With reference to the production of superior Indian silks I quote two papers written about the time when the decline of the silk industry first attracted attention :—

"The fault of the Indian silkworm is that in spinning his fibre he never puts in a sufficiency of 'bone'. 'Bone' means, in the language of the trade, that hardness and firmness in the fibre which enables it to keep its even roundness through all the trials to which it is subjected in dyeing, combing and weaving. If not duly fortified with 'bone' the thread gets frayed at the edges and becomes 'flossy' and flossiness is a quality abhorred by the weaver. It is little differences like this which affect the prosperity of whole industries. The fortunes of the largest silk manufacturer in England have been built on a minute improvement in the process of combing, and the fortunes of Indian silk would revive if its fibre could by any means be hardened a little."—*Tropical Agriculturist*—1886.

Again :—

"The chief objection urged against Bengal filatures in recent years have been unevenness in size, and the difficulty of winding it thus causing frequent breaks. In a country where labour is cheap and abundant, this would not have so rapidly disqualified our silks, but in European industrial centres . . . there has been a strong development of the rights and privileges of the labouring classes, which has often led to a flat refusal to wind Bengal silk, if other work could be got. These manifestations not only meant an increase of

wages for an uncongenial or difficult task, but practically boycotted Bengal silk owing to its inherent defects—a state of things which in some measure explains the decline of Bengal silk during the last ten-fifteen years."—*The Indian Financial Review*—June 18, 1887.

Multivoltine character.—This cross-bred race between the univoltine (one-brooded) Italian-Japanese hybrid and multivoltine (many-brooded) Nistri has for the last twenty generations been more multivoltine than the multivoltine Nistri race of India. In the education of December 1918, 12.777 cocoons, of race 303 alone, were all allowed to "cut out" in order to obtain the correct percentage of univoltines, and it was found that from about 6,400 layings (each laying consists of about 200 to 300 eggs), 23 univoltine layings were obtained and some of these were only partly univoltine. There were probably more multivoltine layings than *half* the number of cocoons as females predominated in that generation. The percentage of univoltines thus works out to about ·3 per cent. The results obtained from the December education was compared with that given by 438 cocoons of the Nistri race the moths of which also cut out in December. The Nistri moths produced 21 univoltine layings out of nearly two hundred layings, giving a percentage of about 10 univoltines.

Method of Selection.—In rearing this multivoltine hybrid race it has been found that the best results are obtained by rearing each laying separately in a medium sized tray of about a yard in diameter. This one-laying system of rearing prevents overcrowding particularly in the early stages. By this system a hardy family of worms would not be contaminated so easily by worms from another laying which are delicate. It is clear that the spread of disease among silkworms in India is mainly due to overcrowding and to the layings of each generation being reared *en masse* in enormous trays.

The Japanese races which are the hardiest and most immune to disease of all silkworm races are, I believe, reared separately with great care in small trays.

Indian rearers could follow this system of rearing to a certain extent, if they placed five to seven layings (according to the race reared) far apart in their large rearing trays. Seven layings of a race of small worms would at the time of spinning fill one of the enormous trays used by them.

Mulberry.—Work is being continued on the various varieties of mulberry to be found under cultivation in India. Careful descriptions and drawings of the flowers are being made and all the forms studied are being preserved in formalin for future reference.

The plot of Cleghorn mulberry cultivated after the Bengal system, but arranged in quincuncial order at Behala, gave a luxuriant crop of leaf during the cold season, when the other varieties of bush mulberry were producing small harsh leaves much disliked by the young worms.

I hope to send about 200 cuttings of this variety of mulberry to Berhampore to see how it does there.

M. L. CLEGHORN.

TABLE I.

Pedigree of 303 Hybrid Race.

This table gives the generation, number of moth and laying, the date of each *elevage* and the number of cocoons to each laying in brackets.

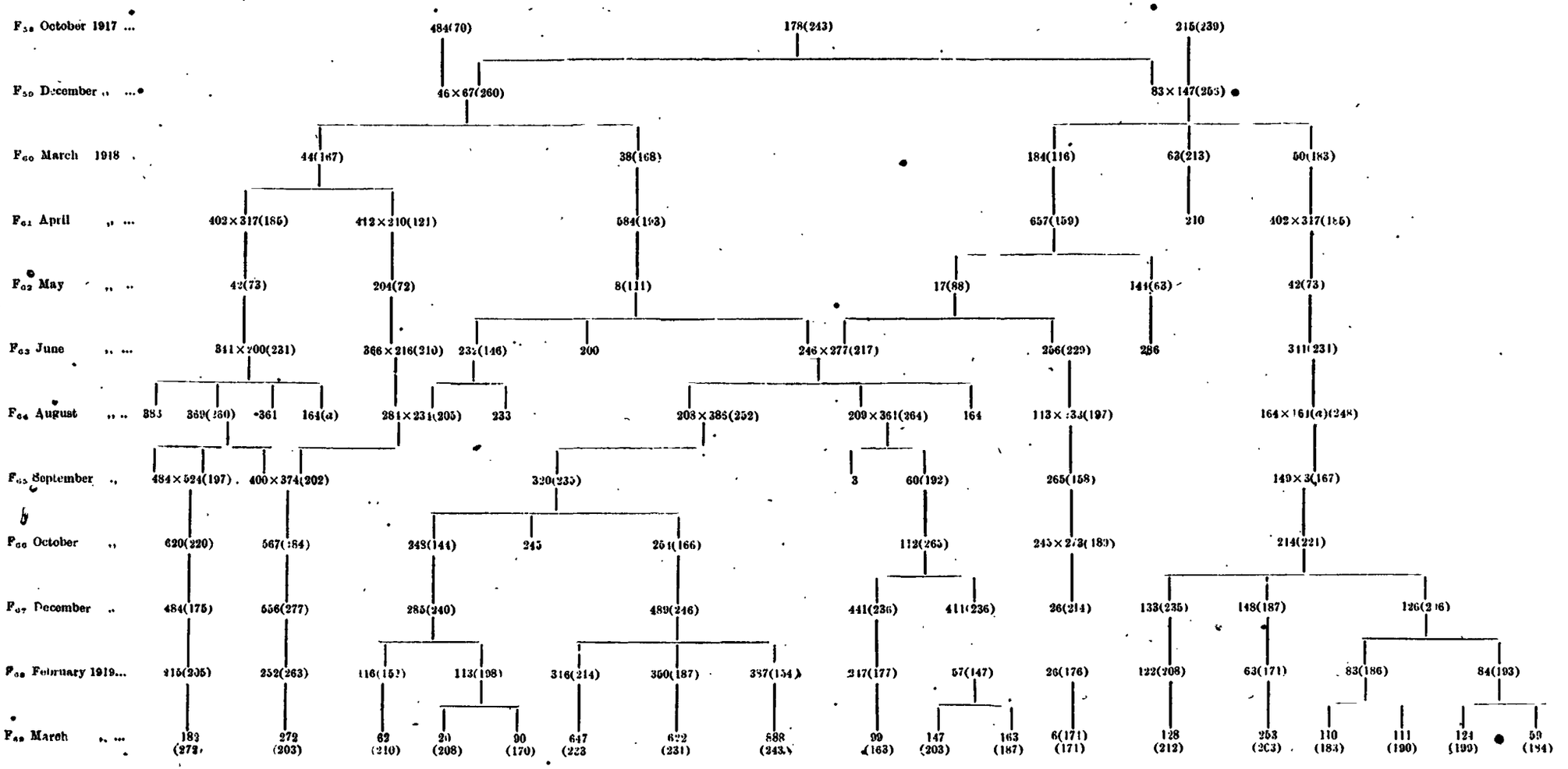
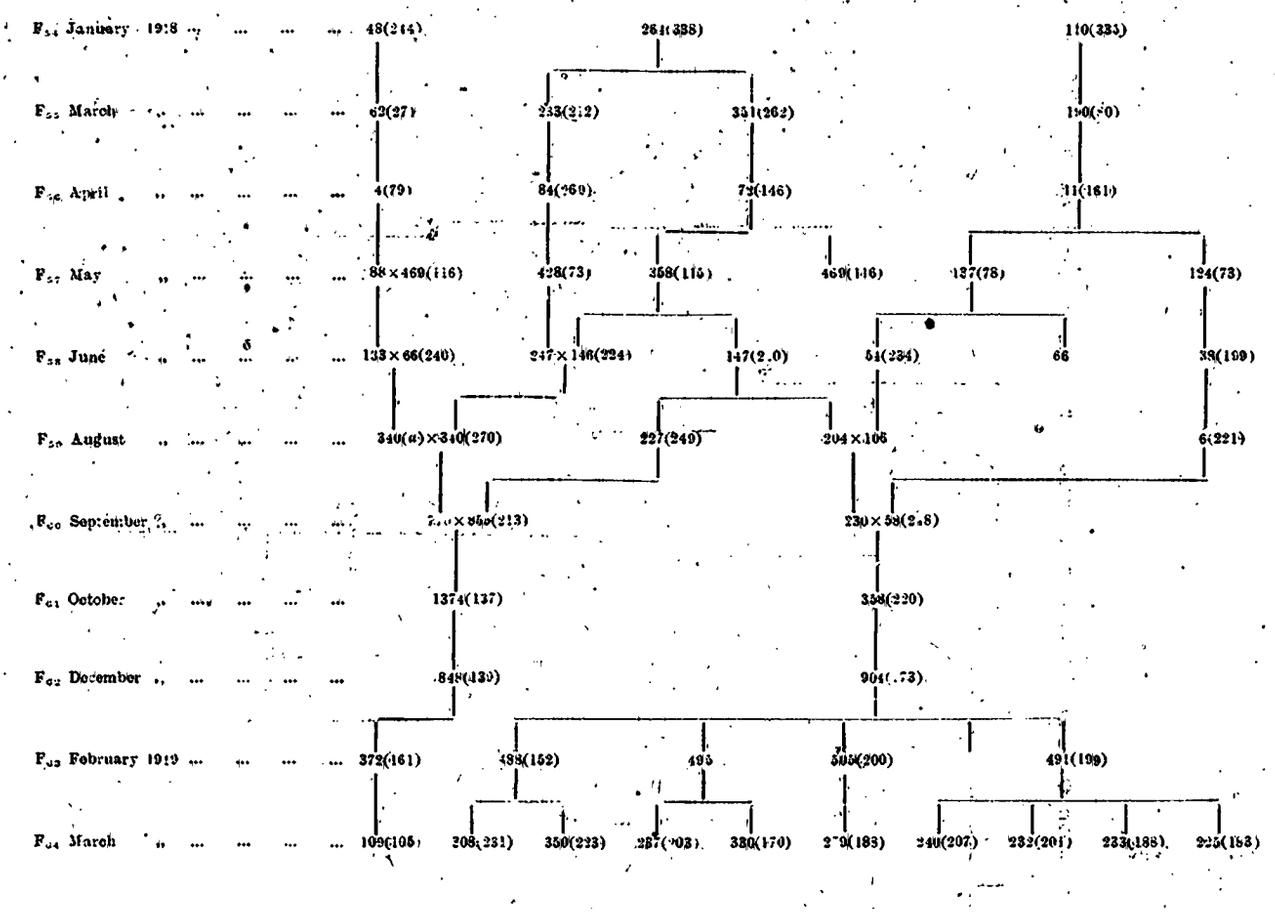


TABLE II.

Pedigree of 329 Hybrid Race.



ANNUAL REPORT ON THE WORK OF THE SERICULTURAL SCHOOL, RAJSHAHI, FOR THE YEAR 1918-19.

The school was made over to Government in January 1907; since then it has been managed by a committee under the Director of Agriculture, Bengal.

The school teaches practical methods of—

(*a*) Mulberry cultivation.
(*b*) Microscopic seed selection.
(*c*) Detection and prevention of silk-worm diseases.
(*d*) Rearing of silk-worm.

The school possesses 22 bighas of land at Kadirgunj about a mile away, of this 17 bighas are under mulberry cultivation.

The cocoons grown in this school are gaining popularity among the Bushnies as they are found to give best result. They take cocoons from this school for their seed. Three crops of cocoons were raised in this school during the year under report, namely, in April and July 1918 and January in 1919, amounting to 209 kahans of cocoons, of which 4 kahons 12 pons were kept in the school for microscopic examination in the class and the rest was sold to the Bushnies of different joars. Although the crop for October could not be reared owing to the destruction of mulberry leaves by the flood the receipt of sale-proceeds was Rs. 584-8 against Rs. 500-4 of the previous year. This increase is due to sale of seed-cocoons the price of which is higher than last year.

Teaching Staff.—There is a headmaster who teaches Sericulture, and with the help of a rearer practical rearing is taught. The headmaster from time to time visited the model rearing houses of passed students and gave instruction to the village Bushnies regarding the rearing of silk-worm.

Model nurseries have been started by the *ex*-students of this school and arrangements have been made to inspect the nurseries and to see how they fare by rearing silk-worms. There are 44 model nurseries started by "passed" students of this school against 35 of the previous year, of these 9 are in Rajshahi and 35 in Malda against 8 in Rajshahi and 27 in Malda of the previous year. Quarterly reports of these model nurseries are called for and received. They show that the nurseries are doing well.

Students.—There were 12 boys in the beginning of this year; three of these have left the school and nine remain. All of them appeared in the final examination and passed. They will receive their rewards in the next winter. Ten boys of the previous year, *i.e.*, of 1916 received the second instalments of their rewards in the year under report. There are ten boys on the roll of whom five are Muhamadans and five Hindus. Each student cultivates a plot of land measuring 1 kotta.

Microscopes.—There are 11 microscopes in stock.

Receipts and Expenditure.

Receipts.	Rs.
Sale-proceeds	585
Government grant	7,225
Total ...	7,810

Expenditure.	Rs.
Establishment	898
Stipends	843
Instruments and appliances ...	450
Books and maps ...	10
Petty repairs ...	325
Purchase of furniture ...	50
Rewards to apprentices ...	2,500
Rents and taxes ...	145
Service Postage ...	5
Travelling and grain compensation allowances ...	132
Miscellaneous	2,452
Total ...	7,810

Discipline.—No breach of discipline in connection with the school has come to the notice of the school authorities during the year under report.

Visitors.—The school was visited by—

The Superintendent of Sericulture, Bengal, on 12th July 1918.
Ditto ditto on 18th December 1918.

Meetings.—The Managing Committee held three meetings during the year under report.

K. BANERJEE,
Secretary of the Sericultural School, Rajshahi.

ANNUAL REPORT OF THE WEAVING EXPERT, BENGAL, FOR THE YEAR 1918-19.

During the period under review I was out on tour for 312 days and visited most of the districts in the Province in connection with the demonstration of improved appliances and accessories as applied to cotton, wool and silk manufacture and to render the textile artisans timely help in their working details. Owing to the increased demand from all parts of the Presidency for the revival of cotton spinning and its preparatory manipulations, more particular attention was paid during the year in the direction of demonstrating and introducing improved *churkas* or " spinning wheels " to the cotton spinning localities and rendering to the weavers, in general, every practical aid as far as time and opportunity could permit. During the year under report I was placed on deputation to hold an enquiry as regards the number of *churkas* in use in the Province ; their requirements in the way of raw cotton ; and how those requirements can be met. I commenced my enquiry in the middle of November and visited the principal localities which had done something towards the improvement of cotton-growing and *churka*-spinning. In this connection I made tours in the districts of *Mymensingh*, *Tippera*, *Noakhali*, *Bankurà*, *Birbhum* and *Pabna* and submitted my report on the enquiry by the latter part of December. On a detailed enquiry it was found that about 5,661 *churkas* were under actual work in the six districts mentioned above, the major portion of them being centred in the districts of *Mymensingh*, *Tippera*, and *Noakhali*. This was mainly due to the fact that the spinners could get their source of raw cotton supply from the Chittagong and Tipperah Hill Tracts and Garo Hills, which are in their neighbourhood. Out of the above number of *churkas* more than 75 per cent. were of recent introduction adopting the improved model. In order to facilitate the supply of improved looms and other appliances and accessories including *churkas* to the increasing demands of the purchasers throughout the Province arrangements were made at five centres, viz., Mymensingh, Comilla, Dacca, Calcutta and *Abadanga* in Birbhum district for their manufacture at moderate rate. As a result 821 model *churkas*, 55 ginning machines, 9 tussar reeling machines, 234 fly-shuttle looms with their complete accessories have already been supplied to the various centres. The distribution of the above-said appliances have afforded greater facilities to the carpenters of the interior villages by serving them as models for manufacturing them on a larger scale. In connection with the introduction of improved appliances, the practical erection and guidance thereof, my frequent visits to the respective localities were indispensable and they helped the artisans to become thoroughly conversant with the uses of the more efficient machines.

I visited the following places in the course of my tours :—

1. Birbhum District—

Kharida ...	...	Cotton and tussar silk weaving.
Kalikapore ...	...	Ditto.
Tattipara ...	...	Cotton weaving and cotton spinning (21 *churkas*).
Birsingpur ...	...	Members under the Co-operative Weavers' Society and other weavers in general.
Bandirbon ...	...	
Katanga ...	...	
Gopalpur ...	...	

Tarapore ...	...	Silk Reelers' Co-operative Society.
Baliara ...	...	Cotton and silk weaving.
Panchgachia	...	Silk Weavers' Co-operative Society.
Kaytha ...	...	Co-operative Weavers' Society and other weavers in general.
Raipur ...	...	Co-operative Cotton Weavers' Society.
Abadanga ...	...	Co-operative Cotton Weavers' Society and the manufacturing centre for loom and other appliances and weaving accessories.
Nanoor ...	...	Cotton weaving in general and cotton spinning (120 *churkas*).
Sukbazar ...	...	Co-operative Weavers' Society and other cotton weavers in general.
Rampur Hât	...	Cotton spinning (35 *churkas*).
Baswa Bishnupur	...	Silk weaving and tussar weaving.

During the Industrial Exhibition at Suri, demonstrations of improved fly-shuttle looms and other pit looms were held to convince the weavers of their working facilities. These were also demonstrated : cotton spinning with *churka* and other improved automatic spinning machines, ginning machines, silk and tussar reeling by means of improved reeling machine, all of which considerably interested the artisans who saw them. As a result of the Suri Exhibition the following orders were taken :—Improved ginning machines 42, *churkas* 20, fly-shuttle looms 21, weaving accessories such as shuttles 14 and reeds about 4,000 dents and the automatic spinning machine 1. The carpenter (loom-maker) of Abadanga who was also present there with his newly prepared looms sold his loom on the spot. The members of the Co-operative Weavers' Societies who exhibited their fabrics of cotton, silk and tussar also sold them at good prices.

2. Bankura District—

Bankura ...	...	Cotton and tussar weaving and wool weaving.
Vishunpur ...	...	Silk weaving.
Rajgram ...	...	Wool and silk weaving.
Birsingpur ...	...	
Gopinathpur ...	...	Silk and tussar weaving.
Lokpur ...	...	Wool weaving

In the above localities, the weavers welcomed help and practical suggestions for the improvement of their preparatory process.

The following places were visited in connection with my special enquiry.

Patpur ...	...	These are cotton producing and spinning centres having at present about 165 *churkas* under work. There is a great demand for more *churkas* and arrangements have been made to manufacture locally *churkas* and ginning machines similar to the models supplied to the local authorities.
Makerkole ...	...	
Dhuapara ...	...	
Danapara ...	...	
Bolara ...	...	
Jagadulla ...	...	
Gopibandi ...	...	
Bashi ...	...	
Kankata ...	...	

3. Bogra District—

Bogra ...	...	Demonstrated silk Reeling and other improved appliances for silk weaving and twisting.

4. Chittagong District—

Bolkali ...	...	Though cotton is obtained from the Hill Tracts, it is scarcely used by the artisans for spinning purposes. The local weavers purchase grey and coloured yarns from the neighbouring markets and manufacture them into lungees, coarse dhooties and saries. They have very recently taken recourse to the use of fly-shuttle looms after a series of demonstrations conducted by me at different centres.
Dholghat ...	...	
Tattipara ...	...	
Sorkijipur ...	...	
Potia ...	...	

5. Tippera District—

Manamathi ...	...	These are the weaving centres where check cloths and other fancy fabrics, dhooties and saries are being manufactured with fly-shuttle looms and other improved accessories.
Ghoshnagar	...	
Ballasher ...	...	
Jafrabad ...	...	
Disaband ...	...	

Dhuliapara	These are cotton spinning localities using Tippera Hill cotton. 2,725 *churkas* are under work and the number is being increased every day. The yarn is either spun in the bazaar or converted into coarse sheets by hand looms and fly-shuttle looms.
Newra	
Rajapara	
Kajipara	
Oniser	
Chowra Bazar ...	
Sewakaji	
Choddugram ...	
Brahmanbaria ...	
Burura Bazar ...	

The weaving class that was organised by me attached to the Comilla artisans school is still working and affords instruction in improved methods to the local weavers and others who are interested in weaving.

6. Dacca District—

Nawabpore	Cotton weaving with finer counts.
Kaira	
Dhamrail	

Automatic looms, fly-shuttle looms and other improvements were demonstrated. Improved *churkas*, automatic spinning machines and ginning machines and combined *churka* and count finder, were introduced among the cotton spinners and weavers to their entire satisfaction. I attended meetings of the Local Home Industries Association and where necessary advised the Secretary and others regarding textile matters. I also attended the Social Service League Exhibition held at Dacca, where automatic spinning machines for short and long stapled fibres, silk reeling, silk spinning, improved *churkas* and ginning machines were practically demonstrated.

7. Faridpur District—

Rajbari	Cotton spinning.
Bhanga	Co-operative Weaver's Society.
Nazirpur	
Merpur	
Paschim Sadardi ...	
Alipore	Other weaving centres.
Majikanta	
Sachinkanta ...	

The weavers and spinners of the above localities were given practical instruction as regard improved spinning and weaving appliances. I also arranged for the supply of raw materials and for sale of the manufactured fabrics at good rates.

8. Malda District—

Shujapur	These are the principal silk reeling centres visited by me in the district. The method of silk reeling by means of my improved reeling machine is gaining popularity and the reelers who reel fine deniers have begun to adopt it.
English Bazar ...	
Perozpur	
Chowdala	
Gayazabari	
Baliadanga	
Shershai	
Dhariapur	
Jagadulla	

9. Darjeeling District—

Darjeeling	The Weavers' Co-operative Society organized by me among the weavers of the Bhutia Busti (Darjeeling) have started their work with yarn from the local bazaar for the time being. Arrangements are being made to supply yarn from Calcutta at wholesale rates, through local agents. The Secretary is busy with the work of collecting the money subscribed by the Managing Directors and other influential local people.

I demonstrated automatic spinning machine and doubling machines to the weavers. At the request of the members a fly-shuttle loom suitable for weaving a full width Bhutia chadar is being despatched. At the request of

the Secretary and other Managing Directors I also convened two general meetings, to bring the society into working state and to collect more working capital.

10. Jalpaiguri District—

Jalpaiguri ...	Inspected the weavers' localities at their request and noted their wants. Arrangements have been made to send yarns and other improved weaving appliances of which they stand in great need at present.

11. Mymensingh District—

Tangail	These are the principal centres possessing both cotton spinners and weavers in abundance. There are altogether 1,525 cotton spinners utilizing Garo Hill cotton. But the weavers always use mill-spun yarn up to 40 s. and finer counts of Manchester yarn. The introduction of Fly-shuttle looms and improved *churka* and ginning machines are being greatly appreciated by the artisans.
Netrakona	
Bazitpore	
Mymensingh ...	
Jamalpur	
Gafargaon	
Pakundia	
Mirzapur	
Pakali	
Dhala	
Dhanbari	
Dewanganj	
Baluka	
Muktagacha	

At the request of the Local Cotton Committee and the District Board, I furnished a scheme for testing the commercial value of the locally prepared hand-spun yarn and to more widely popularize the working of fly-shuttle looms and their improved accessories; also to conduct peripatetic weaving and spinning demonstrations as far as they are practicable. The scheme is now left to the consideration of the District Board. Arrangements were also made for the supply of improved looms, *churkas* and ginning machines to the intending purchasers at reasonable rates. Besides paying my constant visit to the above-mentioned centres, I gave the artisans every assistance in improving their method of manufacture. I also arranged for the sale of their finished products through the Agents at Dacca and Calcutta, who supplied them with raw materials in turn.

12. Murshidabad District—

Berhampore ...	Cotton weaving.
Kagra	
Baluchur	
Jangipur	Wool weaving and Wool Weavers' Co-operaitve Society.
Dhulian	
Regunathganj ...	
Gopalnagar	
Soampara	Silk reeling.
Mirzapur	Silk weaving.
Baidianathpur ...	I visited these places to introduce cotton spinning at the request of the local spinners who stood in need of my help.
Chachua	
Sherpur	
Sundarpur	
Shampur	

13. Midnapore District—

Anandapur	Tussar weaving.
Midnapur	Wool weaving.

Inspected the method of tussar weaving as carried on in Anandapur and found that the yarn was not properly twisted for using in fly-shuttle looms. Necessary instructions for remedying this were given.

14. Noakhali District—

Feni	Cotton weaving with fly-shuttle looms.
Azizfazilpur	
Purvachandrapur ...	
Bairagi Hat	

Kazaribagh ... ... Malipore ... ... Sonapur ... ... Sultanpore ... ... Rhuhitia ... ... Dharmapore ... ... Mazlishpore ... ... Hassanpore ... ... Brinchi ... ... Munshirhat	These are the principal centres visited by me for cotton spinning and weaving with improved *churka* and fly shuttle loom. There are about 955 *churkas* working in the whole locality. The weavers weave coarse *gumchas* and other weaving materials with handspun and mill-made yarns. As a result of former demonstrations fly-shuttle looms are becoming popular almost everywhere in the district.

The establishment of a weaving school at Feni is under contemplation and I have submitted a scheme for the same. Improved looms and other weaving accessories, spinning and ginning machines to the local artisans have been supplied from Dacca and Comilla.

15. Pabna District—

Tagchor ... ... Edarukpur ... ... Tantiband ... ... Tarabaria ... ... Gangarampur ... Kuchiamora ... ... Sibpur	These are the principal weaving centres visited by me. I conducted weaving demonstrations at the respective centres and the requisitions I received for frequent visits to the localities showed that the weavers appreciated the demonstrations.
Sirajganj	Cotton spinning was in vogue here until recently. It is not carried on at present for want of cotton. The spinning machines are being utilized for spinning out of jute. There are 115 spinning machines in the locality and they intend to resume the work on cotton when it is available.
Pabna	Attended an exhibition held at the Co-operative Central Bank and at the request of the Collector and the Registrar of Co-operative Credit Societies demonstrated model *churka* spinning and the use of the ginning machine.

N. N. PILLAI,

Weaving Expert, Bengal.

B. S. Press—30-7-1919—923J—805—R. F.

Published at the Bengal Secretariat Book Depot, Writers' Buildings, Calcutta.

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GOVERNMENT OF BENGAL.

REVENUE DEPARTMENT.

Agriculture Branch.

CALCUTTA, THE 2ND SEPTEMBER 1919.

RESOLUTION—No. 7274.

READ—

The Report on the Operations of the Department of Agriculture, Bengal, for the year 1918-19.

MR. S. MILLIGAN was in charge of the department throughout the year, but after its close was compelled to go on medical leave. Of the two Deputy Directors, Mr. K. McLean returned from military duty to the department early in February and Mr. F. Smith went on leave on account of ill-health at the end of January. In their absence Mr. Rajeswar Das Gupta continued to officiate as Deputy Director during the year, with such success that he has subsequently, with the sanction of the Secretary of State, been appointed permanently to the Indian Agricultural Service and confirmed in the third post of Deputy Director which has been created. The province is still without the services of its separate Chemical Expert, Mr. Annett, who was working in the United Provinces. Mr. Finlow, the Fibre Expert, therefore, performed the duties of Agricultural Chemist in addition to his own. Mr. Hector was Economic Botanist throughout the year. To each division a Superintendent, a member of the Provincial or Bengal Agricultural Service, was attached. The recruitment of district agricultural officers for each district in the Presidency was completed after the close of the year.

2. The number of students from Bengal at the inter-provincial agricultural college at Sabour, in the district of Bhagalpur, in the province of Bihar and Orissa, rose from 17 in the previous year to 32 in the year under review; of these, four held scholarships awarded by District Boards. The advance in numbers is remarkable and is attributed to the stimulus afforded by the creation of a service of district agricultural officers in Bengal, which was at the time under recruitment. On the basis of a scheme formulated by Mr. E. Biss of the Education Department, the establishment of two agricultural vernacular schools, one at Dacca and the other at Chinsura, was sanctioned during the year, for the training of the sons of cultivators in improvements in prelyu practical agriculture. It is hoped that most of the boys who attend these schools will return to their homes to make practical use of what they have been taught; and there is no thought or design of providing them with employment in Government service subsequently. It is expected that the school at Dacca will open in next January. A prospectus is under preparation which will be obtainable from the Director of Agriculture. The result of this experiment will be awaited with much interest. At the same time a scheme for the creation of an Agricultural Institute at Dacca, as foreshadowed by the Calcutta University Commission, is also under consideration.

3. The *indrasail* variety of transplanted *aman* paddy, or winter rice, which the Agricultural Department discovered by a process of selection, continues to be the best in point of view of yield; it is estimated that it yields three maunds per acre more grain than the average of the local varieties it displaces. Originally the distribution of the seed of this variety had been confined to the Dacca and Mymensingh districts; but in the year under

review it was extended over wider areas in Eastern and Northern Bengal, where the variety is reported to be generally suitable. Seventy-five tons of seed were distributed in 10-lbs. packets, and those cultivators, who are so fortunate as to possess a surplus of seed, are supplying their neighbours with seed. It is estimated that there will be 250,000 acres under this variety in the present season, 1919-20. Its success appears to be established. Experiments were made in the selection of the best deep-water winter varieties suitable to the low-lying areas in the east and south-east of the province. The *Kataktara* variety of *aus* paddy, or autumn rice, also discovered by a process of selection, was tested in nearly all the districts in which such rice is grown. It met with remarkable success and a large demand has arisen round centres where the seed has been distributed; for, it is not only superior in yield but also in quality to the ordinary variety of autumn rice. Another variety of autumn rice, viz., the *Surjamukhi*, which appears to have nearly the same advantages as *Kataktara* together with superior advantages in the way of straw, is under experiment. A special effort is also being made to discover an early but heavy yielder for use in the high lands of such districts as Bankura, where the crop is precarious and frequently fails in a year of short rainfall. So far the results from the trials of the selected variety of *Kataktara* as a transplanted rice in that district are encouraging, whilst in the Botanical Section experiments are being made to obtain by a series of crosses a combination in one variety of the two qualities of earliness and high yield. Moreover, a survey of the varieties grown in the Presidency and Burdwan Divisions has been started at Chinsura, with the object of selecting the best early varieties suitable to the west of the province.

4. During the year the distribution of seed of the selected *Kakya Bombai* variety of *Capsularis* jute was extended to cultivators in Eastern and Northern Bengal outside the Dacca and Mymensingh districts to which the distribution had previously been confined. Fifty-five tons of seed were so distributed. Approximately 25 tons in 1918 against 4 tons in 1917 was also distributed in ¼ lb. packets for the multiplication of seed, but only 50 per cent. of the resulting crop was actually used for this purpose; the fibre of the remainder was sold. On account of its heavy yield not only the cultivators, but also the trade, appear to be well satisfied with it for ordinary purposes. It is estimated that it produces two maunds per acre more jute than the average local races, and that 100,000 acres have been planted with it in the present season, 1919-20. The demand for the seed is greater than the supply, with the result that in Faridpur cultivators have been forced to grow their own seed requirements, in this way fulfilling one of the aims of the Agricultural Department. Experiments continued to be made in the selection of the best variety of *Corchorus Olitorius*, which is more suitable to Western Bengal than *Capsularis*. Tests are being made of a promising new race (Chinsura green).

5. Investigations were continued into the "ufra" disease which attacks deep-water paddy. These confirm the general recommendations which have been made with regard to this pest, viz., the burning of the stubble of the previous crop and dealing with the low-lying area which remains wet throughout the year. But as the burning of stubble confers no benefit on the individual unless all his neighbours do it, the lines of attack developed by the department during the year were the conversion of low-lying areas into *boro* lands, and the encouragement of *rabi* cultivation and of the growth of early varieties of paddy which escape the disease.

An investigation into *Chlorosis*, a disease of the jute plant, has led to the tentative conclusion that immunity of the plants to the disease is hereditary in character.

Along with diseases may be mentioned that pest, the water-hyacinth, which is gaining ground in this Presidency with the rapidity of rabbits in Australia. The department has been spreading amongst the cultivators information of the uses which can be made of the weed as a fertilizer, as fuel or as fodder. An apparatus has also been devised for the extraction of potash salts on the spot, but it is expensive to work. Too much emphasis cannot, however, be laid on the fact that such measures for the utilization of the weed, where they can be taken without fear of the pest being exploited

or fostered for commercial gain, are only palliatives. Local bodies have therefore been advised to address themselves to the work of the complete extinction of the weed by uprooting and burning it, root and branch. In this herculean task the Governor in Council invites the co-operation of the whole population.

6. Amongst other activities of the Agricultural Department during the year under review may be mentioned the investigation of fertilizers suitable for jute; the chemical survey of the different soils in the prorvince; the expansion of the new crop of groundnut in the Burdwan Division; the improvement of the tobacco crop; and the examination and selection of local and exotic varieties of sugarcane in respect of their suitability to Bengal conditions. Strides have been made in the work done at the Rangpur cattle farm, and it is now anticipated that the question whether the importation of outside blood is necessary or desirable for the improvement of breed will soon be answered. Until, however, this problem is solved, the Director of Agriculture rightly remarks that such operations should not be extended. During the year, owing to the marked rise in the price of cotton goods, public attention was attracted to the question of extending the cultivation of cotton in Bengal. A free distribution of the Dharwar variety was accordingly sanctioned for the April sowings, the result of which must be awaited; and Mr. N. Pillai, the Weaving Expert, was placed on special duty to investigate the requirements of the local weavers in respect of cotton and the number of *charkas* (spinning wheels) in the province. That conditions in Bengal are not generally favourable to any marked extension of cotton cultivation is now confirmed by the opinion expressed in the report of the Indian Cotton Committee. 1919, that exotic varieties of cotton are unsuited to the climatic and other conditions of the province, and that there seems no prospect of any appreciable extension of the area under the indigenous varieties. The recommendations of that Committee are under examination.

7. In pursuance of the policy of providing each district in Bengal with a farm, the establishment of three new farms was sanctioned in Mymensingh, Comilla and Bogra. It is anticipated that they will be ready for work in the forthcoming cold weather. The District Boards of Pabna and Bakarganj have also come forward with offers of co-operation in the establishment of farms in these two districts. Further, Sir Daniel Hamilton placed a farm at the disposal of the Agricultural Department at Gosaba in the 24-Parganas. The establishment of seed stores at each district headquarters in the province was sanctioned during the year.

8. An encouraging feature of the year is the growth of small non-official thana associations of practical cultivators as a link between the Agricultural Department and the cultivators in the districts of Birbhum and Faridpur. The attitude of Government towards these associations and the functions they are expected to perform in providing this link have been described in an important Resolution, No. 631T.R., published by this Government on the 7th June 1919. Since the close of the year a Board of the Agricultural Department, Bengal, has been established to advise on agricultural questions affecting the whole province. Its constitution is as follows :—

(1) The Director of Agriculture, Bengal, *ex officio* President ;
(2) The Deputy Directors of Agriculture, Bengal ;
(3) The Agricultural Experts in Bengal ; and
(4) The Superintendent, Civil Veterinary Department, Bengal, so long as the Veterinary and Agricultural Departments are amalgamated.

The duties of the Board will be mainly advisory ; they will advise Government on matters referred to them for opinion or on any other matter which the President may consider suitable for discussion. The President is empowered to convene committees to sit at any time during the year, to which visitors may be invited whose presence is necessary for the discussion of the particular matter in hand, such as, representatives of a trade concerned, and others.

There will be an annual meeting which will be held on such date and in such place as the President may decide. To it the Director of Agriculture is

empowered to invite other officials interested in agriculture, large land-owners, representative agriculturists, representatives of the allied trades and others interested in rural development, selected in such a manner as to be representative of the agricultural interests of each district throughout the presidency.

9. Another remarkable feature of the year was the increase in the sale of the Government-examined seed of silkworms by 31 per cent. under the control of Babu A. C. Ghosh, coupled with the discovery that the area of land under mulberry cultivation had increased by 33 per cent. since the year 1913. These facts are both tokens of the growing popularity of the Government seed as well as of a stronger demand for Bengal silk. Cross-breeding experiments were continued both at Berhampore under Mr. P. C. Chaudhuri and in Calcutta under Miss Cleghorn. Certain results have been obtained, but it is not intended to distribute the new hybrid races until their hardiness and immunity to disease under local conditions is established.

10. From the above description of the work of the department during the year, it will appear that there is considerable justification for the Director's assertion that the past year may be said to have been one of all-round progress for the Agricultural Department. If it does not provide a sufficient answer to the critics of the department, who allege that its successes are either non-existent or not very conspicuous, the following quotation from the report may serve to bring home to them the fallacy of such an allegation :—

"The departmentally selected rice and jute at present occupy roughly 250,000 acres and 100,000 acres, respectively. Taking the average increased yields of the improved paddy and jute over local races which they have replaced, to be 3 maunds (240 lbs.) and 2 maunds (160 lbs.) per acre, respectively, we arrive at the conclusion that, in the present year, the Bengal cultivator will, in the aggregate, be better off, on this account alone, by about Rs. 40 lakhs (£250,000 sterling). This figure may be expected to increase rapidly, for practically the whole rice and jute crops of the province will probably be affected in quite a few years. In this case the net income of the cultivators of rice and jute in Bengal would be increased by as much as Rs. 12 crores (£7,500,000 sterling) per annum."

If the department does only this, it will have fully justified its existence, though there are still many other ways in which it can prove its usefulness. The Governor in Council has, therefore, much pleasure in acknowledging the services of Mr. Milligan, the permanent Director of Agriculture, of Mr. Finlow, the present officiating Director, and of those of the officers who have assisted them; the support which has been given them by numerous private individuals, commercial firms and local bodies; and the zeal with which Mr. G. S. Dutt, I.C.S., the Collector of Birbhum, has entered into the question of the development of agriculture in that district.

By order of the Governor in Council,

M. C. McALPIN,
Secy. to the Govt. of Bengal.

No. 7275.

COPY forwarded to the Director of Agriculture, Bengal, for information.

By order of the Governor in Council,

SAIYID ABDUL LATIF,
Under-Secy. to the Govt. of Bengal.

CALCUTTA :
The 2nd September 1919.

B. S. Press—4-9-1919—2054J—941—J. L. C.

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on 01 February, 2020